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An Atlas of the Geographic Distribution of Marine Fish and Invertebrates in the Southern Gulf of St. Lawrence Based on Annual Bottom-Trawl surveys (1971-2002).

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AN ATLAS OF THE GEOGRAPHIC DISTRIBUTION OF MARINE FISH AND INVERTEBRATES IN THE SOUTHERN GULF OF ST. LAWRENCE BASED ON ANNUAL BOTTOM TRAWL SURVEYS (1971-2002)

by

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ABSTRACT

In the southern Gulf of St. Lawrence bottom-trawl surveys have been conducted annually during the month of September since 1971. This atlas is a collection of geographic distribution maps for all the taxa caught during the annual surveys. This report is intended to serve only as an atlas, interpretation of patterns in abundance and distribution necessitates more in-depth analysis and is beyond the scope of this report.

RÉSUMÉ

Des relevés au chalut de fond sont effectués dans le sud du Golfe du Saint-Laurent tous les mois de septembre depuis 1971. Le présent atlas contient une série de cartes de la répartition géographique pour tous les organismes capturés lors de ces relevés. L'intention de ce rapport est seulement de servir comme atlas. Puisque l'interprétation de patrons et tendances dans l'abondance et la distribution des organismes requiert plus d'analyse, celle-ci n'est pas incluse dans le rapport.

INTRODUCTION

Bottom-trawl surveys have been conducted annually in the southern Gulf of St. Lawrence during the month of September since 1971. While these surveys were originally intended to provide abundance indices for commercially important species such as Atlantic Cod, American Plaice and White Hake, information on the abundance and distribution of other species of fish and invertebrates captured during the surveys was also recorded. Swain and Benoît (2001) presented maps for the geographic distribution of sixteen, mainly commercially-harvested, species for six five-year blocks (1971-2000). The purpose of the present atlas is to provide a similar compendium of distribution maps for the entire assemblage of organisms captured during the southern Gulf of St. Lawrence surveys. For each taxon, temporal patterns in their geographic distribution and relative abundance from 1971-2002 are presented in eight maps, each covering a four-year block. Separate maps for catches in numbers·tow^{-1} and kilograms·tow^{-1} are presented for the finfish species, allowing the reader to infer general patterns in size-dependent distribution. Maps for invertebrate species are in kg·tow^{-1} only.

This report is intended to serve only as an atlas (a compendium of maps) of the geographic distribution of fish and invertebrate taxa in the southern Gulf of St. Lawrence. Interpretation of patterns in abundance and distribution necessitates more in-depth analysis and is beyond the scope of this report.

METHODS

The annual Southern Gulf of St. Lawrence bottom-trawl surveys are based on a stratified random design, with stratification based on depth and geographic area (Fig 1). Three inshore strata (401-403) were added to the survey in 1984. Consequently, the geographic distributions presented in this atlas are based on strata 415-439 for 1971-1983, and strata 401-403 and 415-439 for 1984-2002. During these surveys, trawling was conducted at 63-74 sites annually from 1971-1983, 82-132 sites in 1984-1988, 141-188 sites in 1989-1995, and 163-202 sites in 1996-2002 (Fig. 2). The target fishing procedure in all years was a 30 minute tow at 3.5 knots. As such, all catches have been standardised to a 1.75 nautical mile tow.

The surveys were carried out by the *E.E. Prince* from 1971-1985 using a Yankee-36 trawl, by the *Lady Hammond* from 1985-1991 using a Western IIA trawl and by the *Alfred Needler* since 1992 also using a Western IIA trawl. Fishing was restricted to daylight hours (07:00-19:00) from 1971 to 1984 but has been conducted 24-hr per day since 1985. Adjustments for differences in catchability between vessels and gears, based on comparative fishing experiments in 1985 and 1992, have been made where applicable (Benoît and Swain, *in prep.*; Nielsen 1994). Similarly, adjustments for diel differences in catchability have been applied where necessary (Benoît and Swain, 2003, *submitted*). Where adjustments were applied, catches were adjusted to be equivalent to day catches

by the *Alfred Needler* using a Western IIA trawl. Further details on the annual survey can be found in Hurlbut and Clay (1990).

Since 1971, survey protocol has been to sort (and record) the catch from each tow by species for all finfish and for commercially important invertebrates (lobster, crabs, shrimp, squid and scallops). Species identification at sea is problematic for three fish genera in particular: *Liparis* (seasnails), *Lycodes* (eelpouts) and *Sebastes* (redfish). While attempts are made to identify the former two genera to the species level, it is felt that this has been done inconsistently and the reliability of the identification is questionable. Consequently these are grouped to the genus level in this atlas. Geographic distribution maps for *Liparis* sp. are likely mainly *L. gibbus* (dusky seasnail), but may also include instances of *L. atlanticus* (Atlantic seasnail), *L. fabricii* (gelatinous seasnail) and *L. liparis* (striped seasnail). Similarly, *Lycodes* sp. includes mainly *L. lavalaei* (Laval's eelpout), *L. vahlii* (Vahl's eelpout), with a few possible instances of *L. reticulatus* (Arctic eelpout), *L. pallidus* (pale eelpout) and *L. esmarki* (Vachon's eelpout). As for redfish, no attempts are made to differentiate to species in the southern Gulf surveys, although these would mainly be *S. fasciatus* and *S. mentella*. Finally, barracudina have been grouped to the family level (Paralepididae) because although the vast majority of instances are of white barracudina (*Arctozenus risso*), there are a few unconfirmed records of *Paralepis coregonoides*.

Catches of most invertebrates without commercial importance were only sporadically recorded in the surveys prior to 1985. The sorting, identification and

recording of invertebrate catches has been part of the regular survey protocol since that year. While efforts have been made to identify them to the lowest practical taxonomic level, a refining in the taxonomic identification of several of these taxa is evident in the data from 1985 to the early 1990s. Consequently, for several invertebrate taxa we provide distribution maps for coarse taxonomic resolution (e.g. phylum, class or order) followed by maps for finer resolution (family, genus or species). While the former will include all records for that level of resolution (e.g. all bivalves) the latter will only include those records where that taxon was identified at the finer taxonomic resolution (e.g. Iceland scallops). Consequently the reader should be aware that although maps for the entire survey period are provided for each invertebrate taxon, those prior to 1985 will likely not include the majority of instances where that taxon was caught, and geographic distributions for 1985 onwards will have similar limitations for finer levels of taxonomic resolution.

Contour maps of the geographic distribution of the various species were created for 4-yr time periods using the ACON software package (ACON Win95 8.37, Fisheries and Oceans Canada). Interpolation for the contours is based on Delaunay triangles, with contour levels representing the 10, 25, 50, 75 and 90th percentiles of non-zero catches. To avoid the inappropriate formation of Delaunay triangles between distant points and points topologically separated by barriers, a blanking distance of 0.7 degrees was used as the distance limit between data points at which Delaunay triangles were removed. If one or more sides of a Delaunay triangle had a length that exceeded this value the triangle was not contoured. This value for the blanking distance was chosen as the best

compromise between providing accurate local depictions of organism abundance while not over extrapolating into areas where the organism was not caught.

CONSIDERATIONS

The maps presented in this atlas reflect the distribution of marine fish and invertebrates as sampled by the bottom-trawl in September. Because the fishing efficiency of the gear can vary enormously among taxa and with organism body size for example (Harley and Myers 2001), abundances should be considered as relative. As well, the full geographic distribution of many inshore taxa may not be well represented because the survey strata do not cover nearshore areas with depths less than about 20 m. Lastly, because many of the taxa undergo seasonal migrations, the maps presented here reflect the late summer and early fall distribution and may not be representative of other times of the year (for further information on the seasonal distribution of these taxa, refer to Darbyson and Benoît (2003) or Hurlbut and Benoît (2001)).

RESULTS

Geographic distribution maps are presented for all taxa occurring in approximately 50 or more sets over the 1971-2002 period. Separate maps for catches in numbers·tow^{-1} and kilograms·tow^{-1} are presented for the finfish species, with only the latter presented for invertebrate taxa. Each series of maps consist of eight panels, each covering a four-year block. These maps are indexed in Table 1. For all other species that

were only occasionally caught in the surveys, Table 2 provides a summary of the size, frequency and location (strata) of catches for each 4-yr time period.

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Table I. Index of species distribution maps for the September bottom-trawl survey in kg·tow^{-1} (Fig. a) and numbers·tow^{-1} (Fig. b) for finfish and in kg·tow^{-1} only for invertebrates taxa.

Order	Scientific Name	Common Name	Figure #
Aulopiformes	Paralepididae	Barracudina	3 a, b
Clupeiformes	*Alosa pseudoharengus*	Gaspereau	4 a, b
	Alosa sapidissima	American Shad	5 a, b
	Clupea harengus	Atlantic Herring	6 a, b
Gadiformes	*Boreogadus saida*	Arctic Cod	7 a, b
	Enchelyopus cimbrius	Fourbeard Rockling	8 a, b
	Gadus morhua	Atlantic Cod	9 a, b
	Gadus ogac	Greendland Cod	10 a, b
	Melanogrammus aeglefinus	Haddock	11 a, b
	Merluccius bilinearis	Silver Hake	12 a, b
	Phycis chesteri	Longfin Hake	13 a, b
	Pollachius virens	Pollock	14 a, b
	Urophycis tenuis	White Hake	15 a, b
	Nezumia bairdii	Marlin-Spike Grenadier	16 a, b
Gasterosteiformes	*Gasterosteus aculeatus aculeatus*	Threespine Stickleback	17 a, b
Lophiiformes	*Lophius americanus*	Monkfish	18 a, b
Myxiniformes	*Myxine glutinosa*	Northern Hagfish	19 a, b
Perciformes	*Ammodytes dubius*	Northern Sand Lance	20 a, b

Table I. continued

Order	Scientific Name	Common Name	Figure #
Perciformes	*Anarhichas lupus*	Striped Atlantic Wolffish	21 a, b
	Cryptacanthodes maculatus	Wrymouth	22 a, b
	Tautogolabrus adspersus	Cunner	23 a, b
	Scomber scombrus	Atlantic Mackerel	24 a, b
	Eumesogrammus praecisus	Fourline Snakeblenny	25 a, b
	Lumpenus fabricii	Slender Eelblenny	26 a, b
	Lumpenus lampretaeformis	Snakeblenny	27 a, b
	Leptoclinus maculatus	Daubed Shanny	28 a, b
	Ulvaria subbifurcata	Radiated Shanny	29 a, b
	Peprilus triacanthus	Butterfish	30 a, b
	Gymnelus viridis	Fish Doctor	31 a, b
	Lycodes sp.	Eelpout	32 a, b
	Zoarces americanus	Common Ocean Pout	33 a, b
	Melanostigma atlanticum	Altlantic Softpout	34 a, b
Pleuronectiformes	*Glyptocephalus cynoglossus*	Witch Flounder	35 a, b
	Hippoglossoides platessoides	American Plaice	36 a, b
	Hippoglossus hippoglossus	Atlantic Halibut	37 a, b
	Limanda ferruginea	Yellowtail Flounder	38 a, b
	Pseudopleuronectes americanus	Winter Flounder	39 a, b
	Reinhardtius hippoglossoides	Greendland Halibut (turbot)	40 a, b
	Scophthalmus aquosus	Windowpane	41 a, b
Rajiformes	*Amblyraja radiata*	Thorny Skate	42 a, b
	Leucoaja ocellata	Winter Skate	43 a, b
	Malacoraja senta	Smooth Skate	44 a, b
	Unidentified skate	Skate Egg Cases	44 c

Table I. continued

Order	Scientific Name	Common Name	Figure #
Osmeriformes	*Mallotus villosus*	Capelin	45 a, b
	Osmerus mordax mordax	Rainbow Smelt	46 a, b
Scorpaeniformes	*Leptagonus decagonus*	Atlantic Sea Poacher	47 a, b
	Aspidophoroides monopterygius	Alligatorfish	48 a, b
	Artediellus uncinatus	Arctic Hookear Sculpin	49 a, b
	Hemitripterus americanus	Sea Raven	50 a, b
	Icelus spatula	Spatulate Sculpin	51 a, b
	Myoxocephalus octodecemspinosus	Longhorn Sculpin	52 a, b
	Myoxocephalus scorpius	Shorthorn Sculpin	53 a, b
	Triglops murrayi	Mailed Sculpin	54 a, b
	Cyclopterus lumpus	Lumpfish	55 a, b
	Eumicrotremus spinosus	Atlantic Spiny Lumpsucker	56 a, b
	Liparis sp.	Unidentified Seasnail	57 a, b
	Sebastes sp.	Unseparated Redfish	58 a, b
Squaliformes	*Centroscyllium fabricii*	Black Dogfish	59 a, b
	Squalus acanthias	Spiny Dogfish	60 a, b

Phylum/Class	Taxonomic Resolution	Common Name	Figure #
		Unseparated Marine Invertebrates	61
Ascidiacea	Tunicata	Tunicates	62
Crustacea	Decapoda	Decapod Shrimp	63

Table I. continued

Phylum/Class	Taxonomic Resolution	Common Name	Figure #
Crustacea	Pandalidae	Pandalid Shrimp	64
	Crangonidae	Snapping Shrimp	65
	Cancer borealis	Jonah Crab	66
	Cancer irroratus	Atlantic Rock Crab	67
	Hyas sp.	Toad Crabs	68
	Chionoectes opilio	Snow Crab	69
	Lithodes maja	Northern Stone Crab	70
	Homarus americanus	Lobster	71
	Paguroidae	Hermit Crabs	72
Polycheata	Polycheata	Bristle Worms	73
	Aphrodita sp.	Sea Mice	74
Gastropoda	Gastropoda	Snails and Slugs	75
	Buccinum sp.	Welks	76
Bivalvia	Bivalvia	Bivalve molluscs	77
	Cryptodonta, Pterimorpha, Palaeotaxodonta, Heterdonta, Priondesmata, Teleodesmata sub-classes	Clams	78
	Arctica islandica	Ocean Quahog	79
	Cardiidae	Cockles	80
	Pectinidae	Scallops	81
	Placopecten magellanicus	Sea Scallop	82
	Chlamys islandicus	Iceland Scallop	83
	Mytilidae	True mussels	84
Cephalopoda	Loliginidae, Ommastrephidae	Squids	85

Table I. continued

Phylum/Class	Taxonomic Resolution	Common Name	Figure #
Cephalopoda	*Illex illecebrosus*	Short-Finned Squid	86
	Loligo pealei	Long Finned Squid	87
	Octopoda	Octopus	88
Polyplacophora	Polyplacophora	Chitons	89
Echinodermata	Echinodermata (phylum)	Echinoderms	90
Stelleroidea	Asteroidea	Starfish	91
	Asterias sp.	Unidentified starfish	92
	Henricia sanguinolenta	Blood Star	93
	Solaster sp.	Sun Stars	94
	Ctenodiscus crispatus	Mud Star	95
	Ophiuroidae	Brittle Stars	96
	Gorgonocephalida and Asteronychidae	Basket Stars	97
Echinoidea	*Strongylocentrotus* sp.	Sea Urchins	98
	Clypeasteroida	Sand Dollars	99
Holothuroidea	Holothuroidea	Sea Cucumbers	100
	Psolus fabricii	Scarlett Psolus	101
Cnidaria	Cnidaria	Polyps	102
Anthozoa	Anthozoa	Sea Anemones	103
	Pennatula borealis	Great Sea Pen	104
Scyphozoa	Scyphozoa	Large Jellyfish	105

Table I. continued

Phylum/Class	Taxonomic Resolution	Common Name	Figure #
Porifera	Porifera	Sponges	106
Thallophyta	Thallophyta	Algae and Kelp	107
		Garbage	108

Table II. Finfish species that were only occasionally caught in the southern Gulf of St. Lawrence annual surveys (1971-2002). The location of catches by stratum (bold), along with the number of individuals caught and the frequency of catches (in parentheses) are presented for eight 4-yr periods.

Species	1971-1974	1975-1978	1979-1982	1983-1986	1987-1990	1991-1994	1995-1998	1999-2002
Northern Wolffish (*Anarhichas denticulatus*)	**438**, 3 (1)	**438**, 1 (1)		**415**, 1 (1) **426**, 12 (1) **437**, 1 (1)	**415**, 4 (3) **426**, 1 (1)	**416**, 2 (1) **437**, 10 (1)	**439**, 1 (1)	**425**, 2 (2)
Fourspine Stickleback (*Apeltes quadracus*)						**423**, 1 (1)		
Atlantic Argentine (*Argentina silus*)				**425**, 2 (2) **439**, 1 (1)			**415**, 3 (2) **425**, 1 (1) **439**, 3 (3)	**433**, 1 (1)
Atlantic Menhaden (*Brevoortia tyrannus*)								**434**, 1 (1)
Longfin Seasnail (*Careproctus longipinnis*)		**422**, 2 (1)	**419**, 1 (1)	**417**, 3 (2) **418**, 1 (1) **422**, 1 (1)		**439**, 1 (1)		**424**, 1 (1)
Viperfish (*Chauliodus sloani*)							**426**, 11 (1)	

Table II. continued

Species	1971-1974	1975-1978	1979-1982	1983-1986	1987-1990	1991-1994	1995-1998	1999-2002
Polar Sculpin (*Cottunculus microps*)			**415**, 3 (2)	**437**, 1 (1)		**416**, 1 (1) **425**, 1 (1) **437**, 1 (1) **439**, 1 (1)	**415**, 1 (1) **417**, 2 (1) **419**, 1 (1) **423**, 9 (5) **424**, 2 (1) **425**, 1 (1) **427**, 3 (1) **439**, 4 (4)	**423**, 5 (2) **424**, 1 (1) **427**, 1 (1) **431**, 1 (1) **433**, 1 (1)
Arctic Staghorn Sculpin (*Gymnocanthus tricuspis*)						**431**, 1 (1)	**416**, 1 (1) **418**, 1 (1) **422**, 2 (1) **424**, 1 (1) **427**, 2 (2) **438**, 1 (1)	**419**, 19 (1) **420**, 1 (1) **423**, 1 (1) **424**, 1 (1) **427**, 2 (2) **435**, 1 (1)
Stout Eelblenny (*Lumpenus medius*)				**419**, 1 (1)	**419**, 1 (1)		**417**, 13 (1) **418**, 3 (2) **419**, 81 (3) **422**, 11 (4) **423**, 1 (1)	
Common Wolf Eelpout (*Lycenchelys paxillus*)							**419**, 2 (1) **422**, 2 (1)	

Table II. continued

Species	1971-1974	1975-1978	1979-1982	1983-1986	1987-1990	1991-1994	1995-1998	1999-2002
Wolf Eelpout (*Lycenchelys verrilli*)								**416**, 1 (1) **439**, 1 (1)
Atlantic Silverside (*Menidia menidia*)				**402**, 31 (3) **420**, 41 (1) **421**, 4 (1) **432**, 6 (2)	**402**, 1 (1) **432**, 1 (1)		**402**, 28 (6) **432**, 8 (4)	**402**, 1 (1) **432**, 1 (1)
Atlantic Tomcod (*Microgadus tomcod*)				**422**, 1 (1)				
Lanternfish (*Myctophidae*)				**438**, 2 (1)		**439**, 1 (1)		
Little Grubby (*Myoxocephalus aeneus*)							**416**, 1 (1) **427**, 4 (2) **435**, 1 (1) **436**, 1 (1)	
Arctic Sculpin (*Myoxocephalus scorpioide*)						**423**, 1 (1) **429**, 2 (1)	**401**, 10 (1) **420**, 1 (1) **422**, 1 (3) **423**, 30 (12) **427**, 3 (2) **429**, 1 (3) **431**, 1 (1)	

Table II. continued

Species	1971-1974	1975-1978	1979-1982	1983-1986	1987-1990	1991-1994	1995-1998	1999-2002
Lowfin Snailfish (*Paraliparis calidus*)							**425**, 1 (1)	
Sea Lamprey (*Petromyzon marinus*)					**431**, 1 (1)	**403**, 1 (1) **415**, 1 (1) **417**, 1 (1)	**417**, 1 (1) **432**, 1 (1) **439**, 1 (1)	
Rock Gunnel (*Phollis gunnellus*)				**419**, 1 (1)	**431**, 2 (2)		**418**, 3 (1) **419**, 1 (1) **422**, 2 (1)	**424**, 1 (1) **432**, 1 (1)
Barndoor Skate (*Raja laevis*)	**415**, 1 (1) **425**, 1 (1)		**425**, 1 (1)	**425**, 1 (1)	**416**, 1 (1) **425**, 1 (1) **436**, 1 (1) **438**, 1 (1)			
Atlantic Salmon (*Salmo salar*)					**432**, 1 (1)			
Atlantic Saury (*Scomberesox saurus*)					**436**, 1 (1)	**423**, 1 (1)	**425**, 1 (1)	**423**, 3 (2) **425**, 1 (1) **429**, 1 (1) **437**, 1 (1)

Table II. continued

Species	1971-1974	1975-1978	1979-1982	1983-1986	1987-1990	1991-1994	1995-1998	1999-2002
Arctic Shanny							**401**, 2 (2)	**401**, 1 (1)
(*Stichaeus punctatus*)							**420**, 2 (2)	**418**, 1 (1)
							421, 1 (1)	**420**, 2 (2)
							422, 1 (1)	**423**, 1 (1)
							423, 1 (1)	**427**, 2 (2)
							427, 1 (1)	**428**, 5 (2)
							428, 1 (1)	**431**, 1 (1)

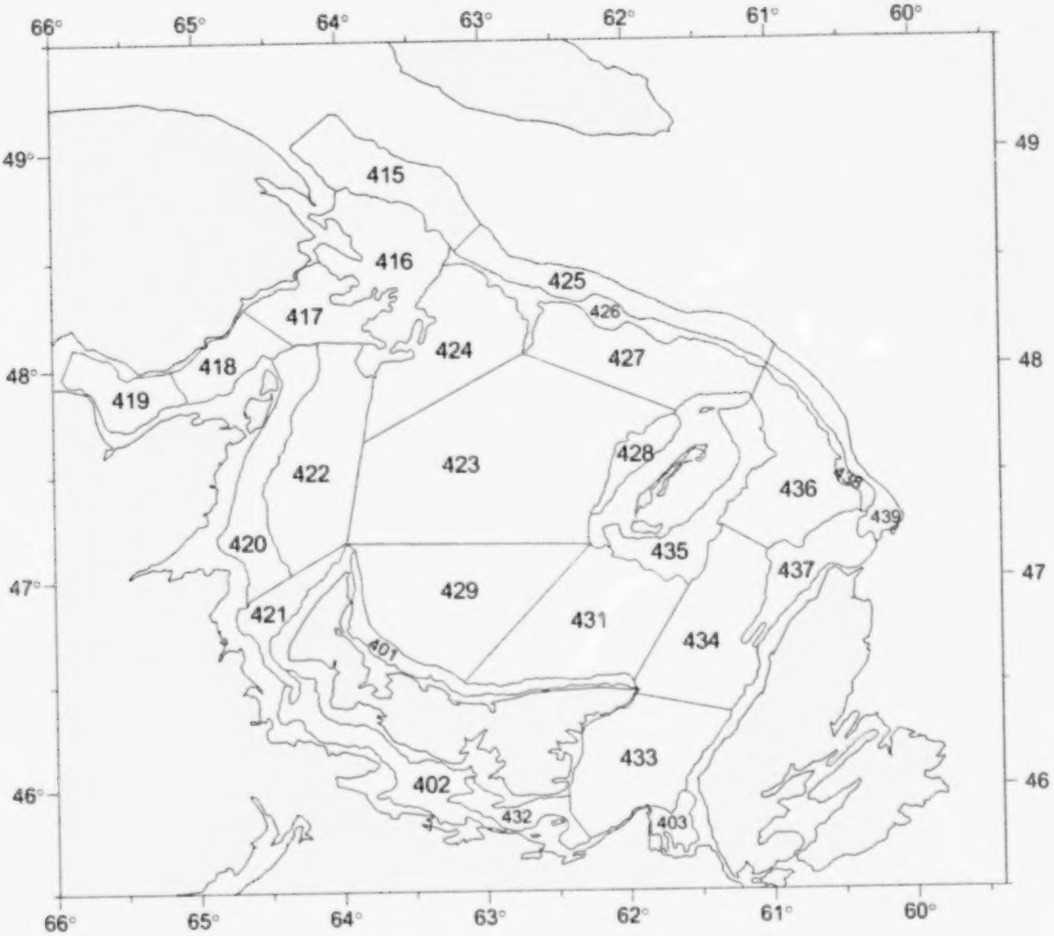

Figure 1. Stratum boundaries for the September bottom-trawl survey of the southern Gulf of St. Lawrence.

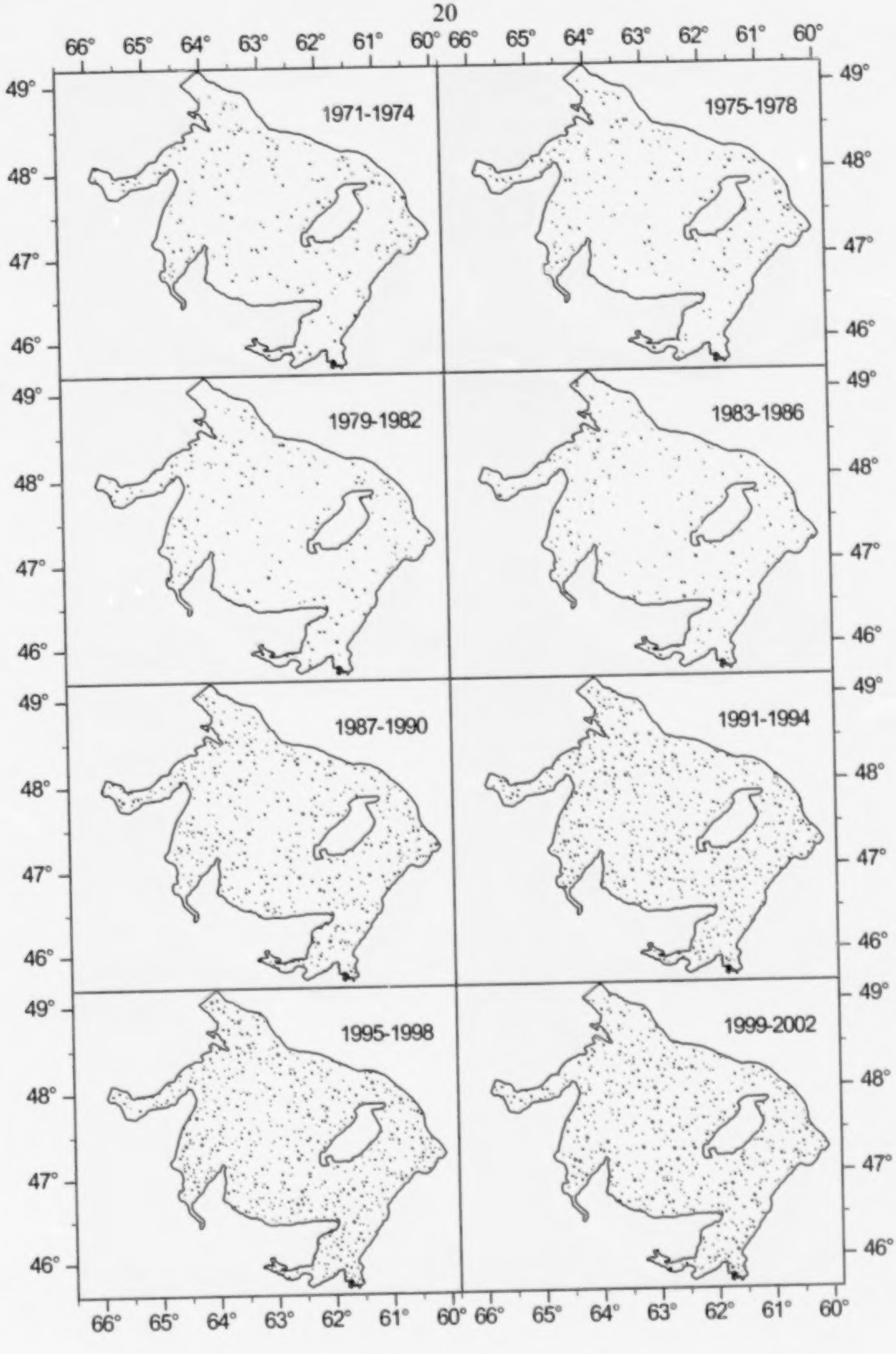

Figure 2. Location of stations sampled during the annual September bottom-trawl survey of the southern Gulf of St. Lawrence (1971-2002)

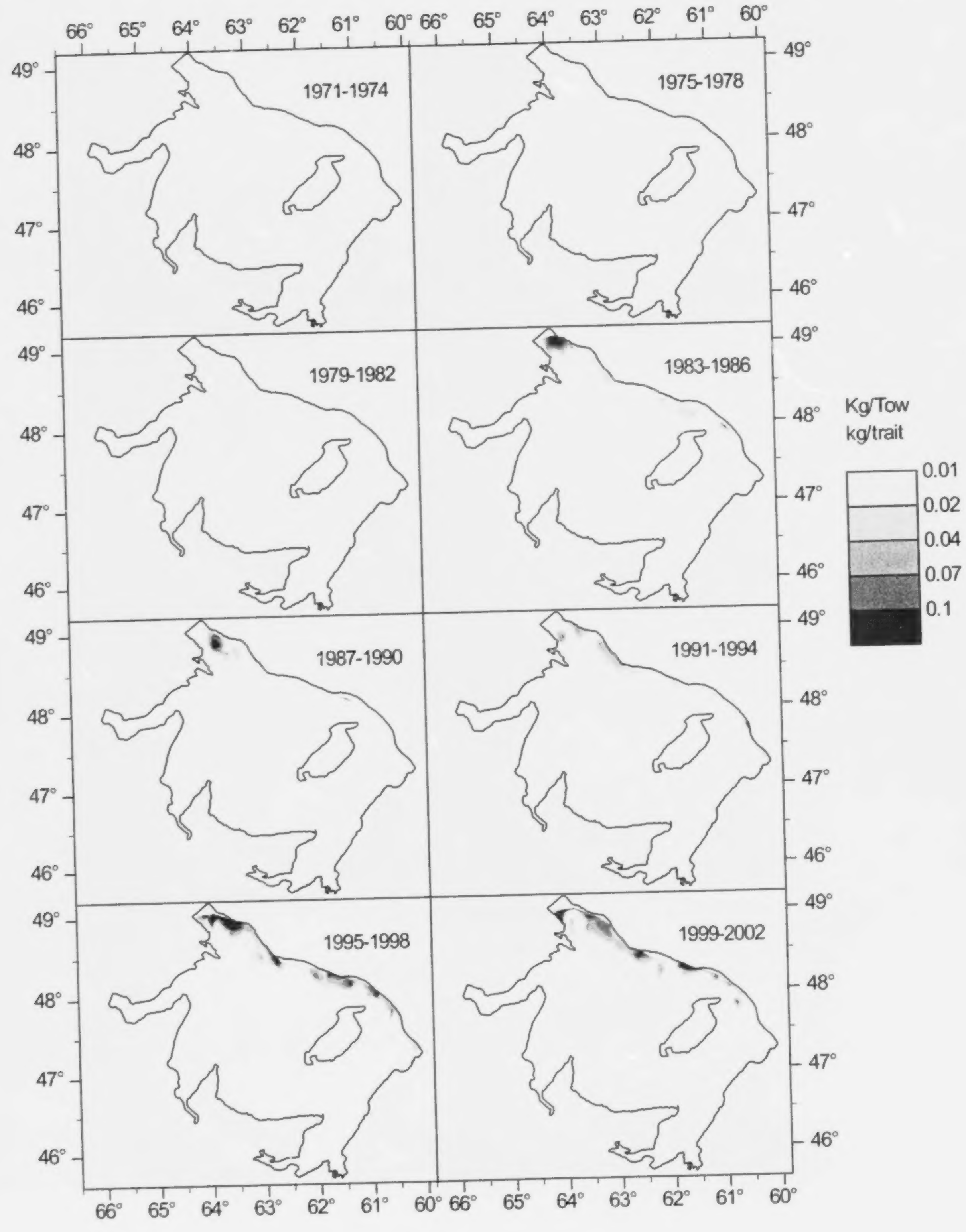

Figure 3a. September distribution of catches (kg) of Barracudina, Paralepididae

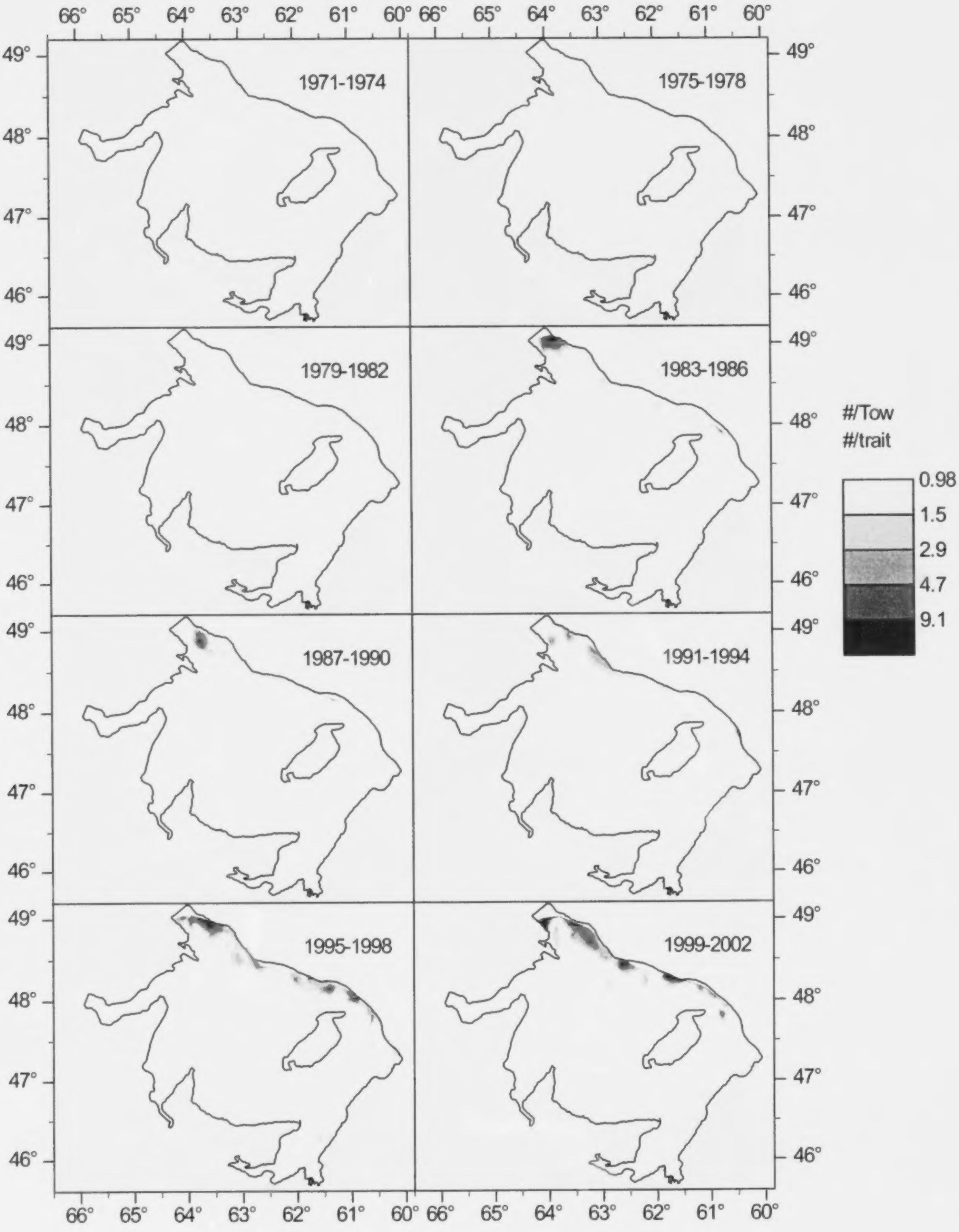

Figure 3b. September distribution of catches (#) of Barracudina, Paralepididae

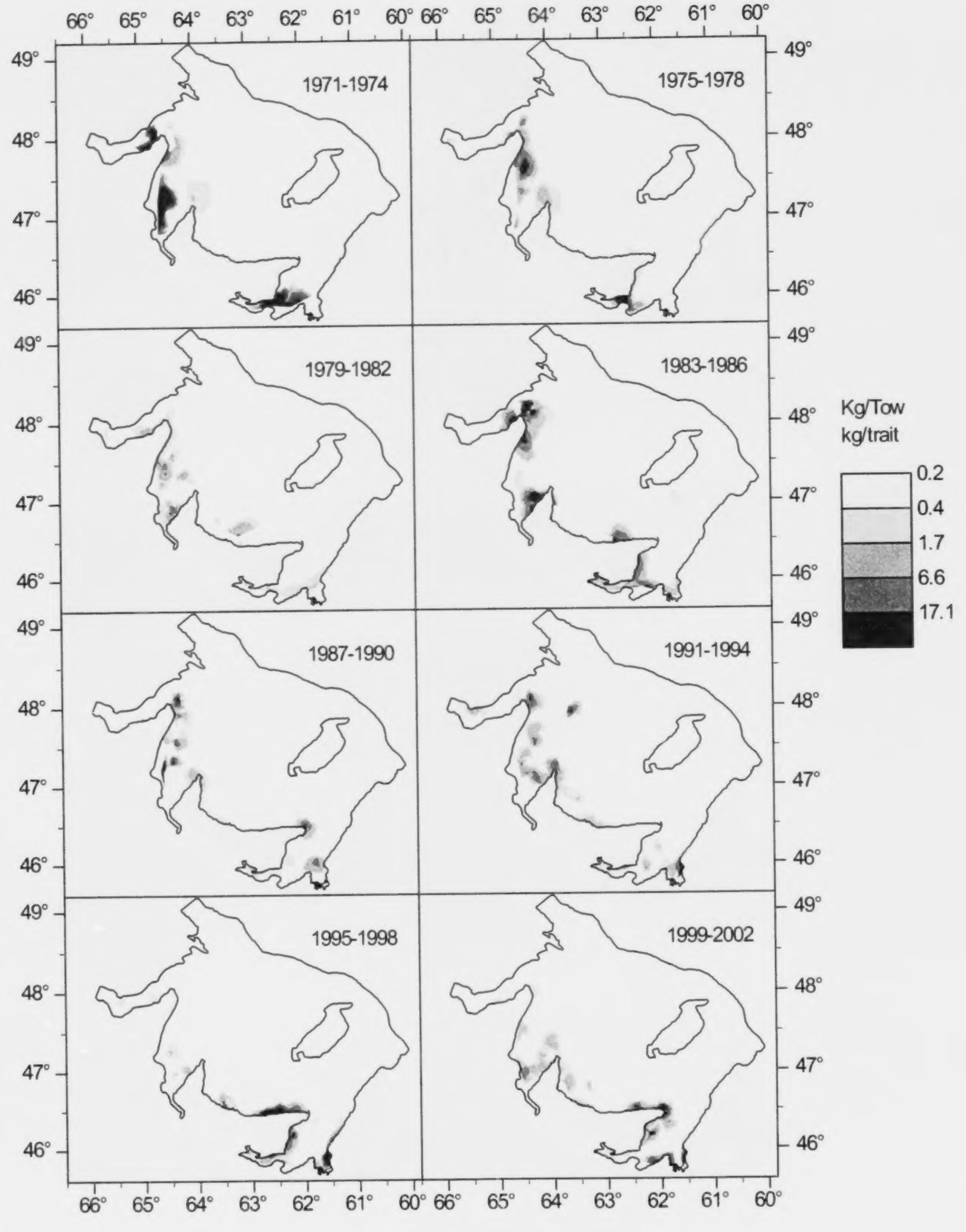

Figure 4a. September distribution of catches (kg) of Gaspereau, *Alosa pseudoharengus*

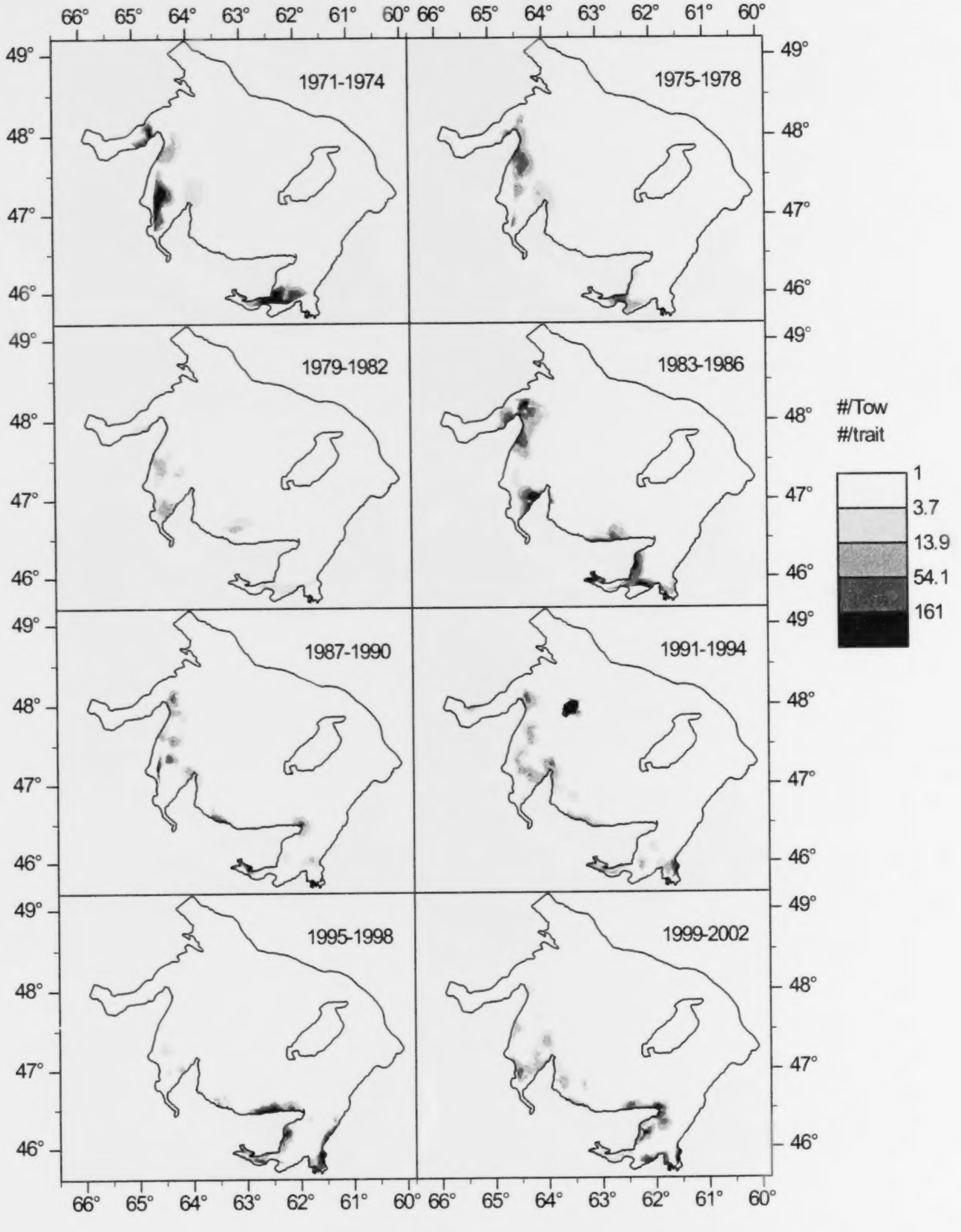

Figure 4b. September distribution of catches (#) of Gaspereau, *Alosa pseudoharengus*

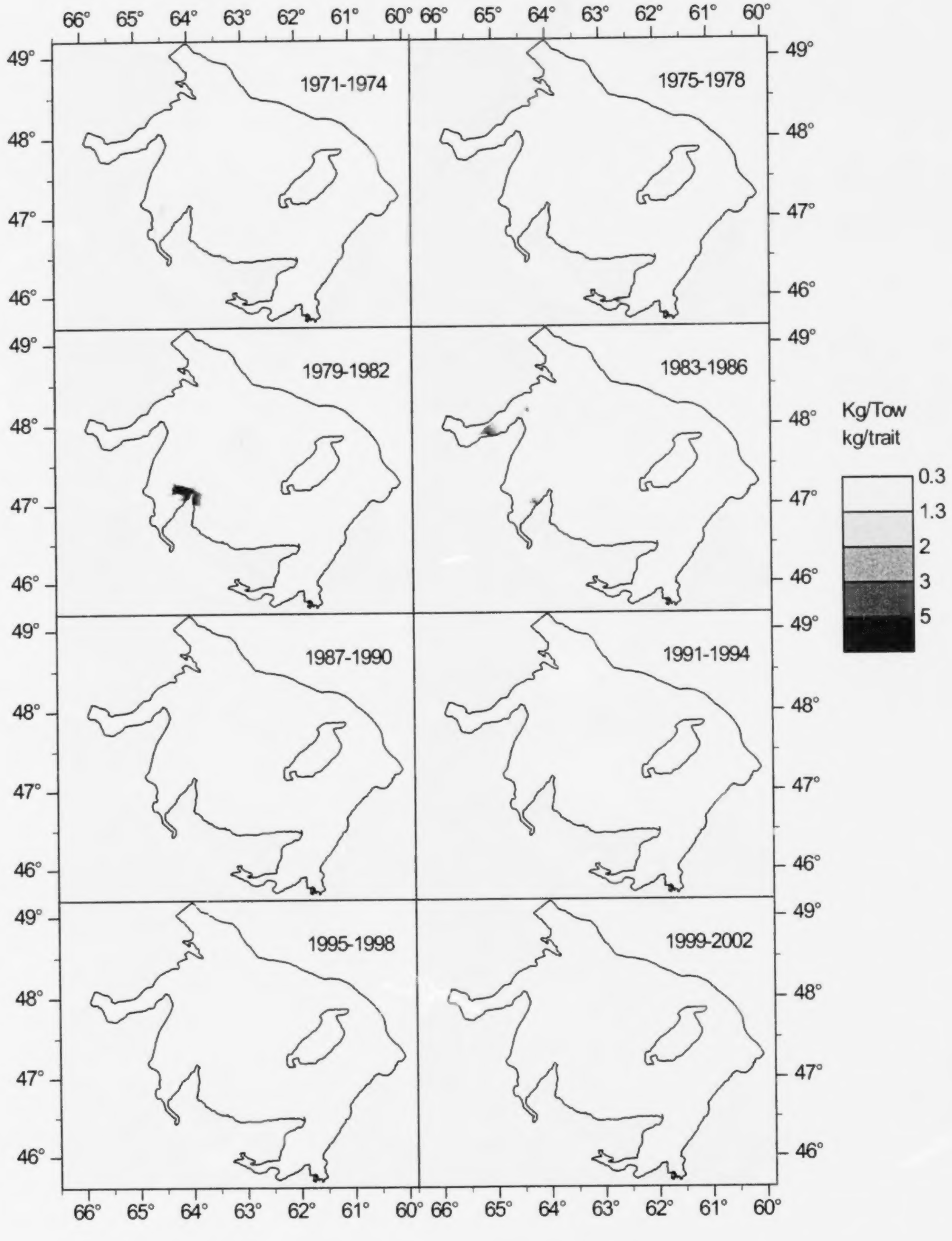

Figure 5a. September distribution of catches (kg) of American Shad, *Alosa sapidissima*

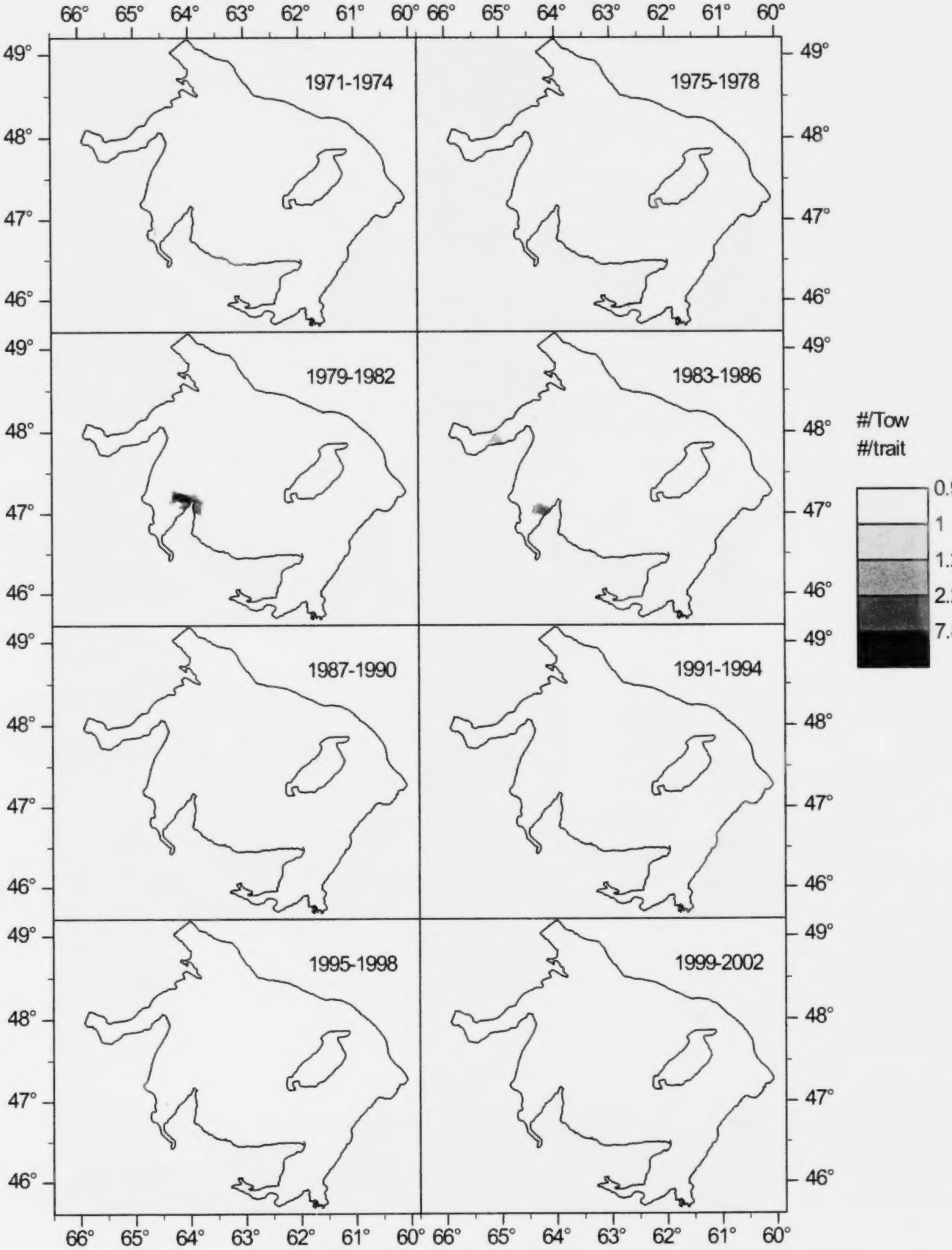

Figure 5b. September distribution of catches (#) of American Shad, *Alosa sapidissima*

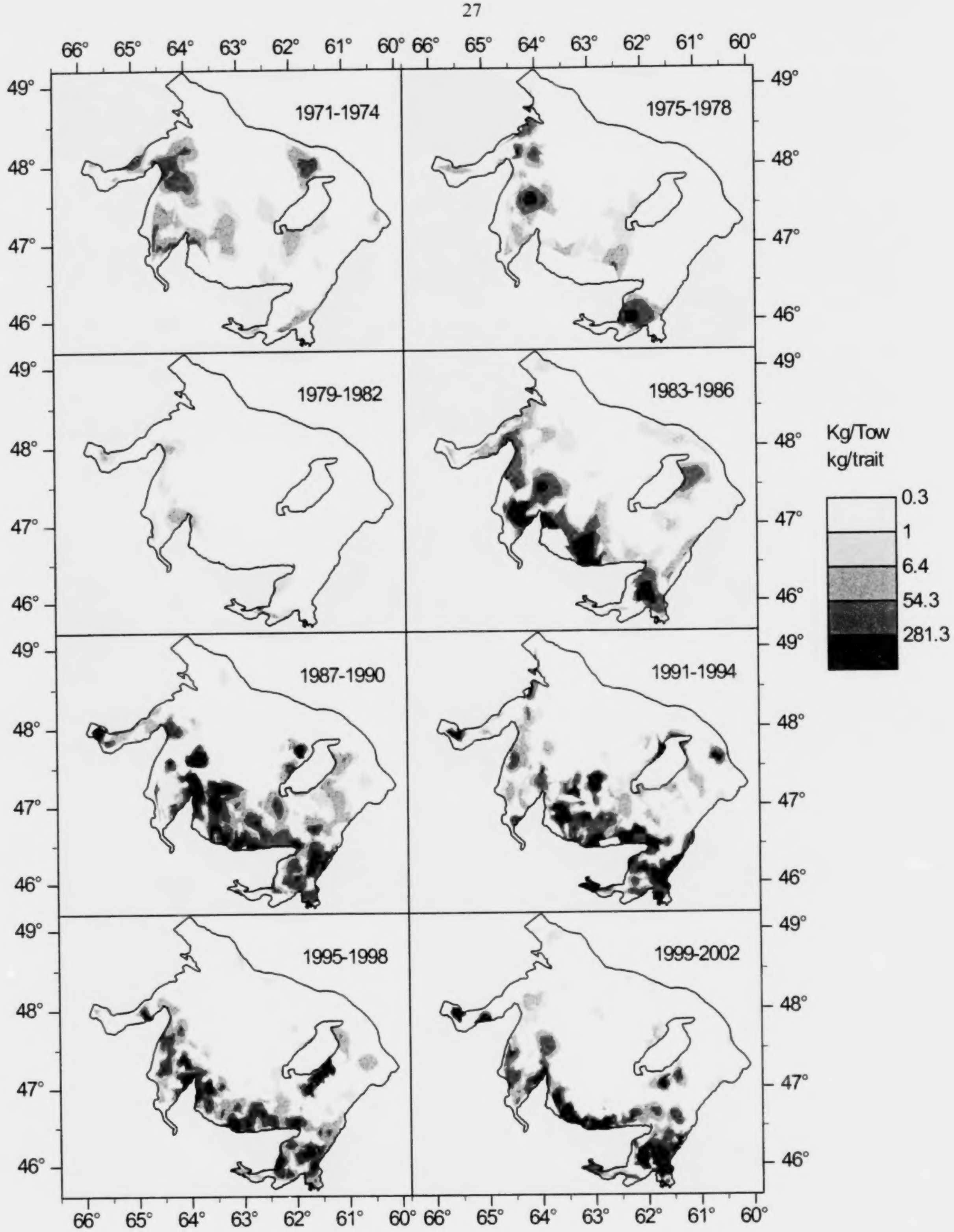

Figure 6a. September distribution of catches (kg) of Atlantic Herring, *Clupea harengus*

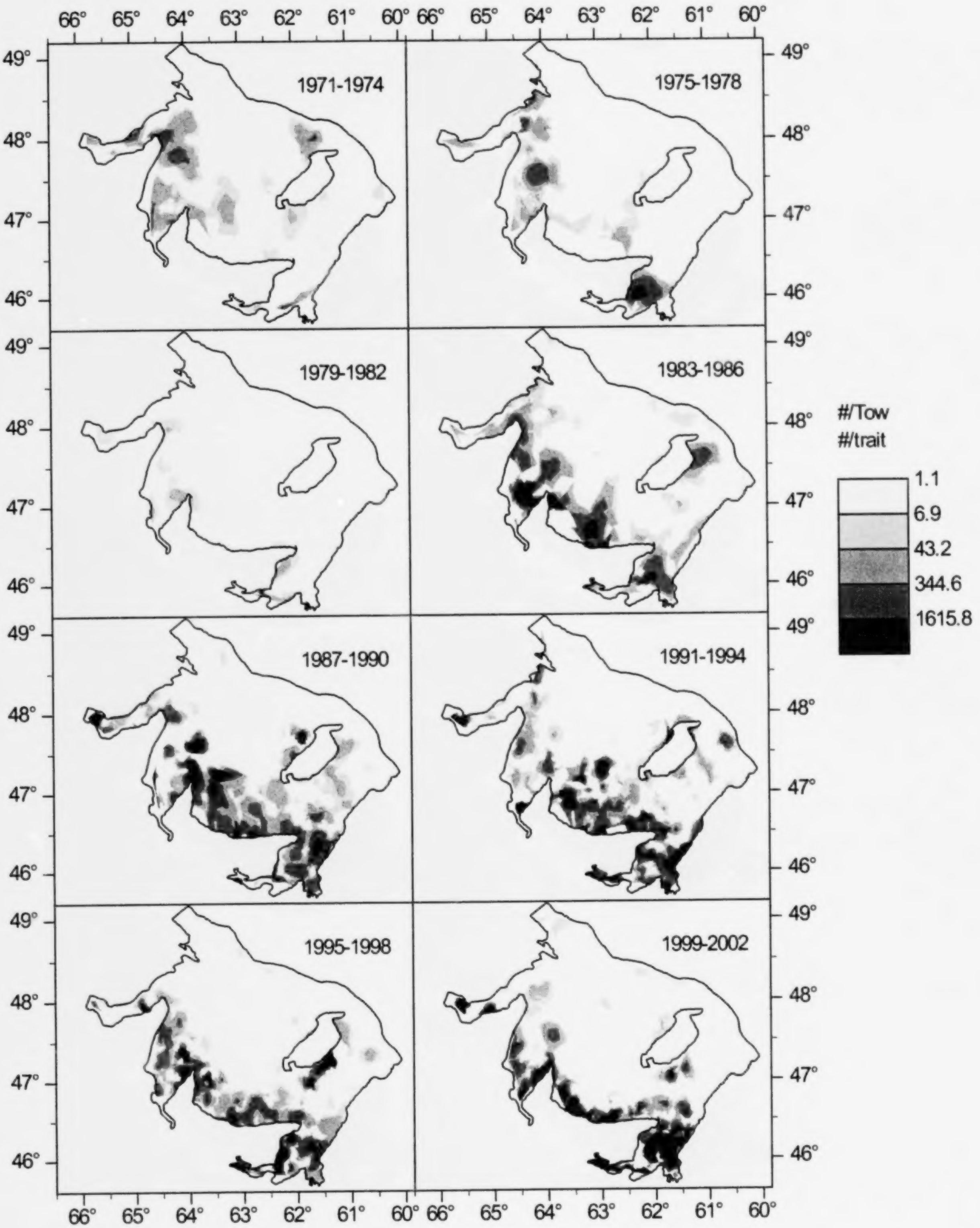

Figure 6b. September distribution of catches (#) of Atlantic Herring, *Clupea harengus*

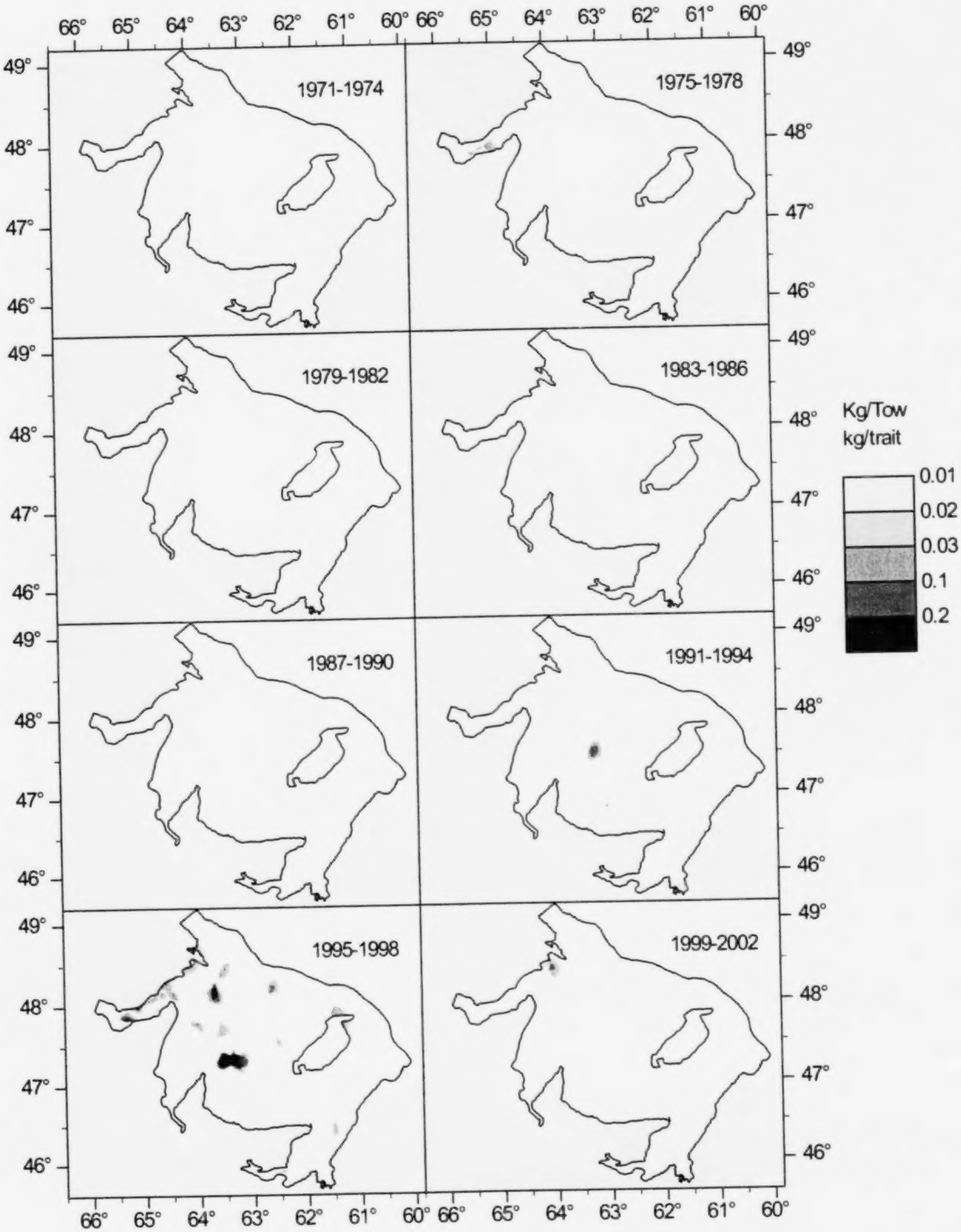

Figure 7a. September distribution of catches (kg) of Arctic Cod, *Boreogadus saida*

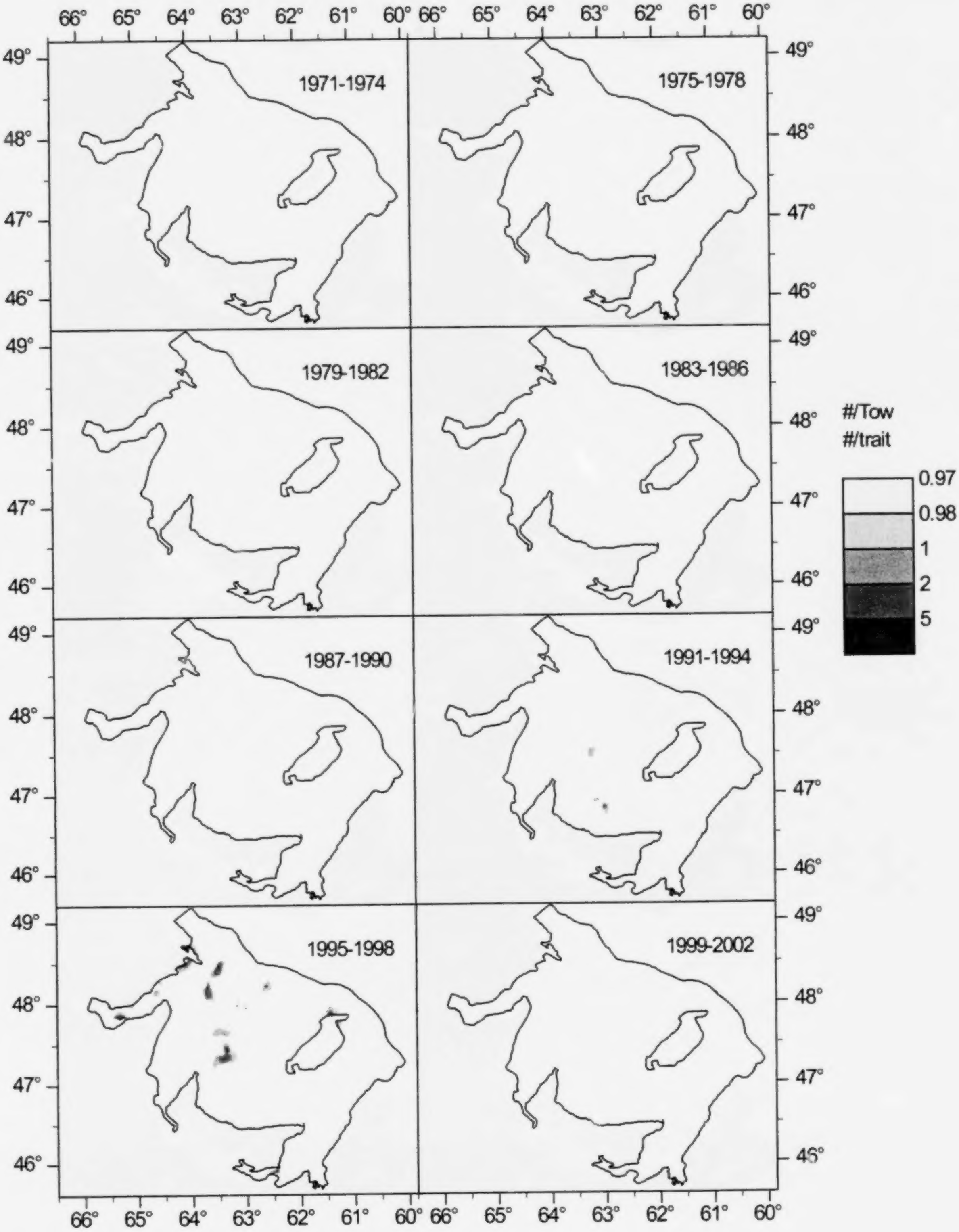

Figure 7b. September distribution of catches (#) of Arctic Cod, *Boreogadus saida*

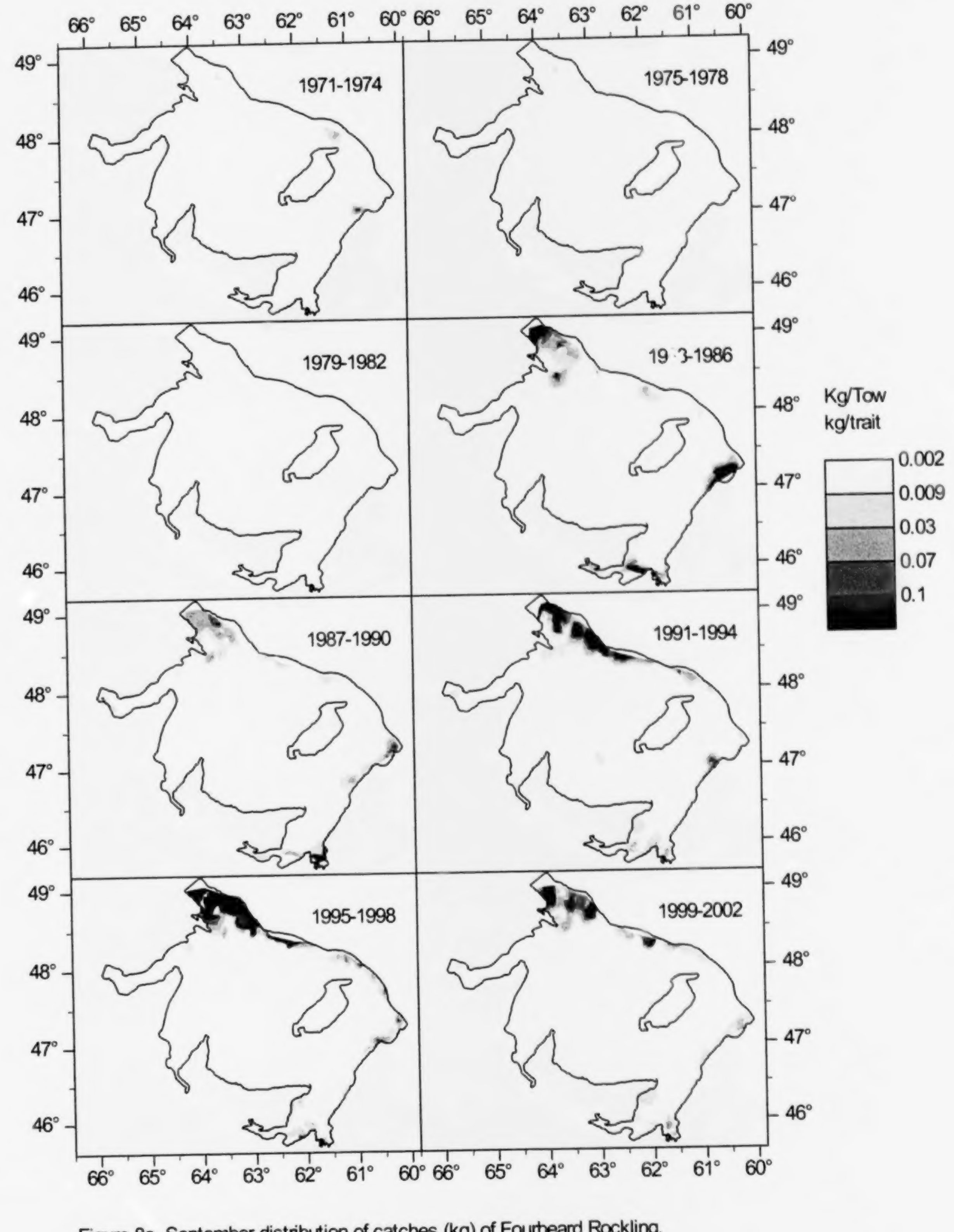

Figure 8a. September distribution of catches (kg) of Fourbeard Rockling, *Enchelyopus cimbrius*

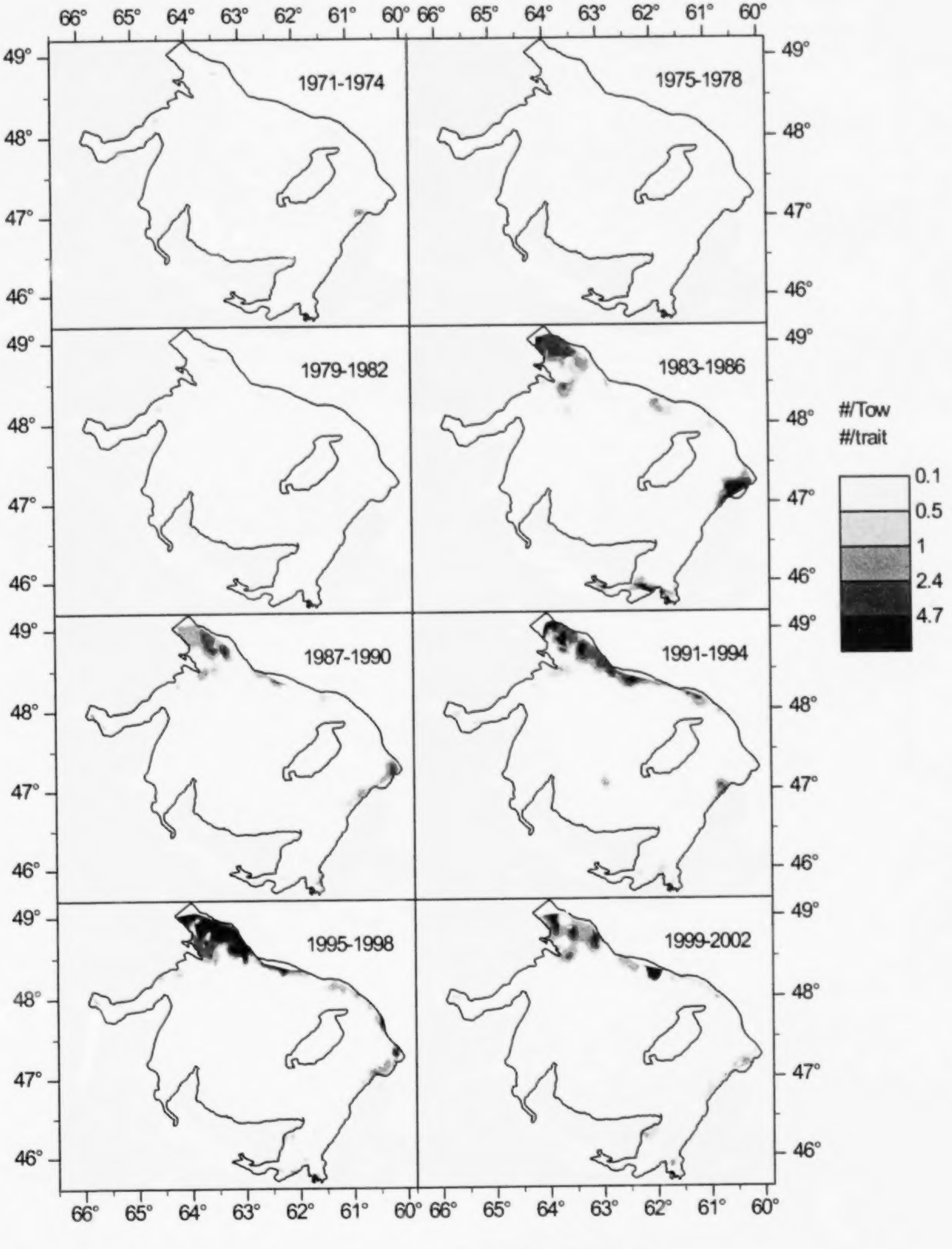

Figure 8b. September distribution of catches (#) of Fourbeard Rockling, *Enchelyopus cimbrius*

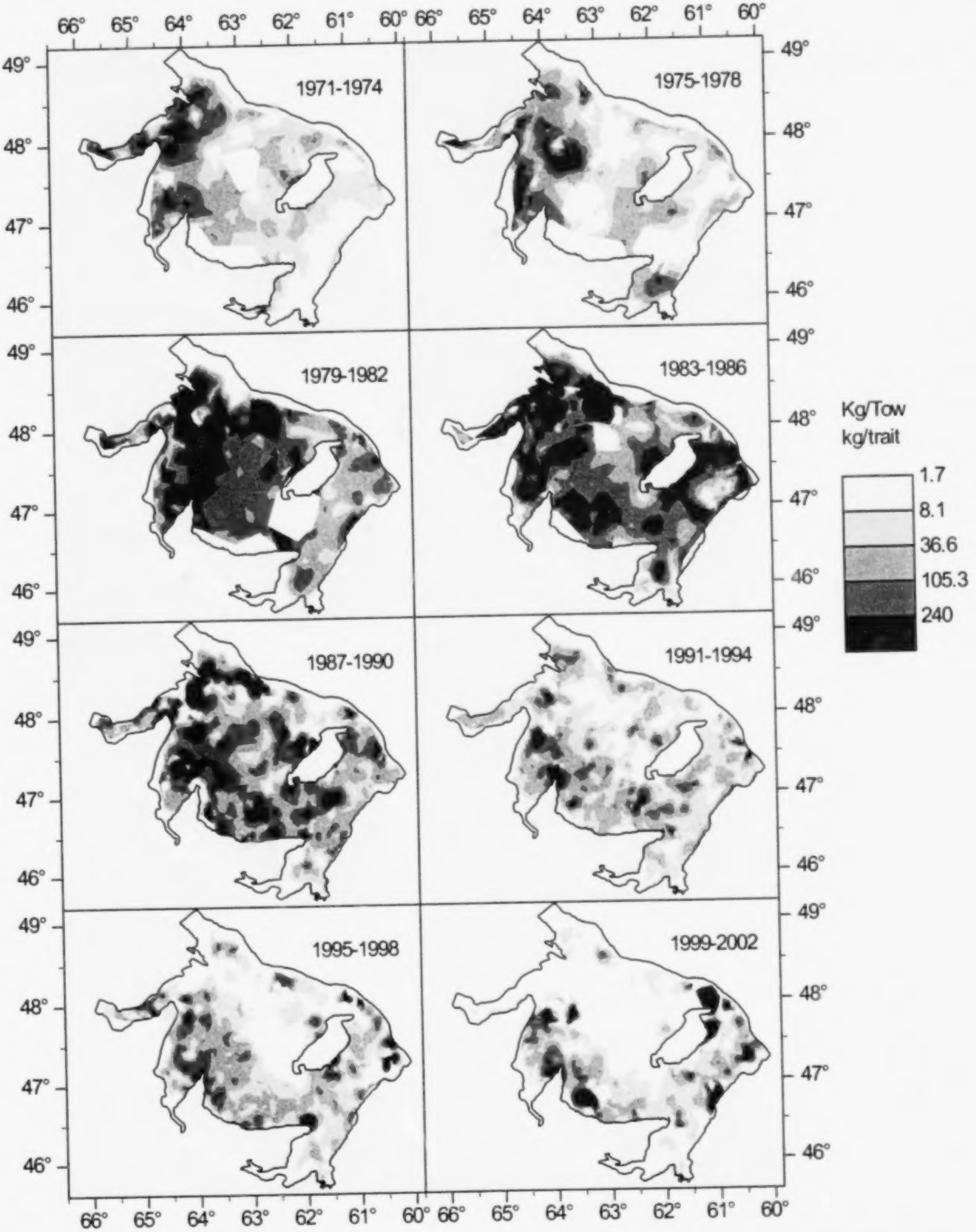

Figure 9a. September distribution of catches (kg) of Atlantic Cod, *Gadus morhua*

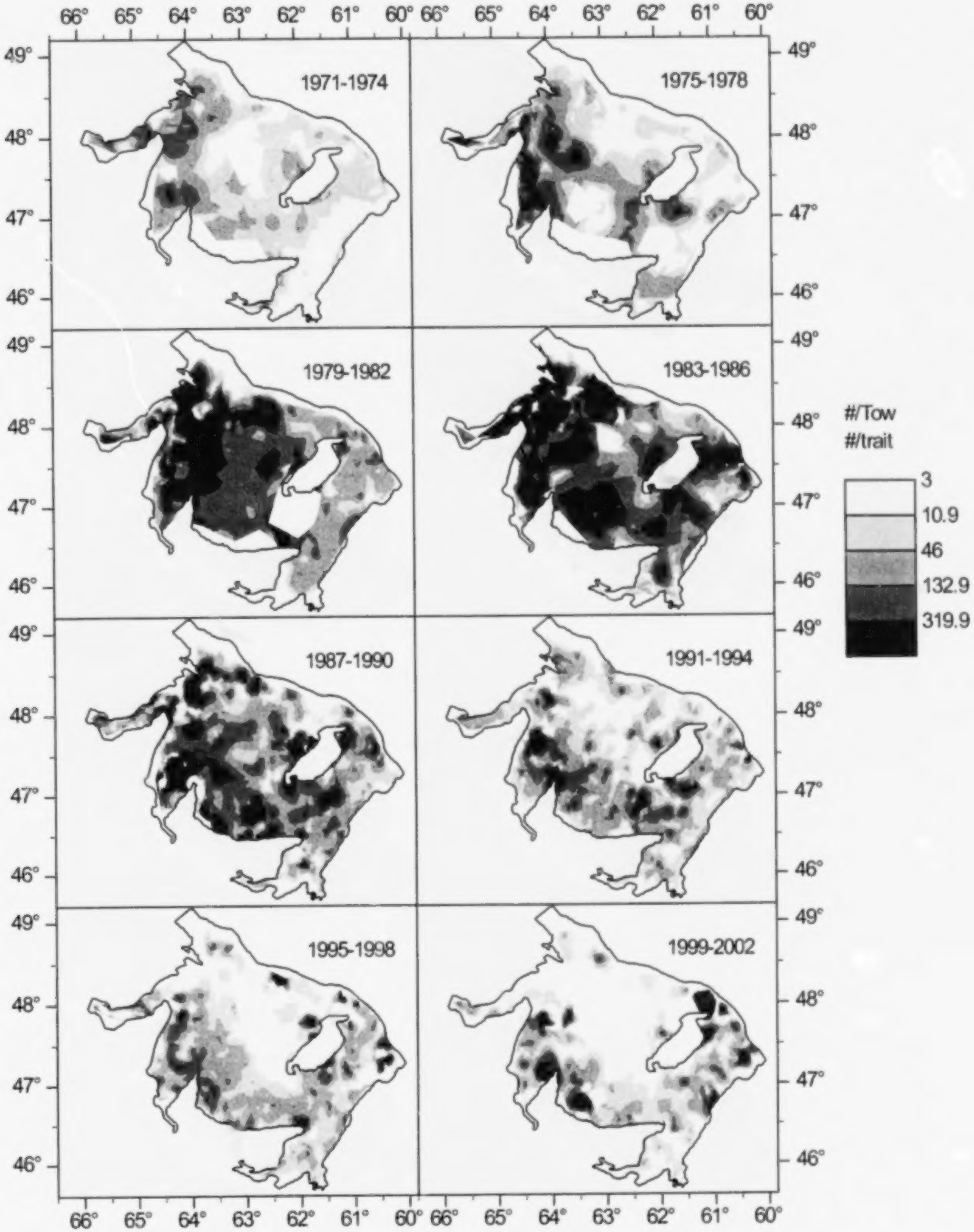

Figure 9b. September distribution of catches (#) of Atlantic Cod, *Gadus morhua*

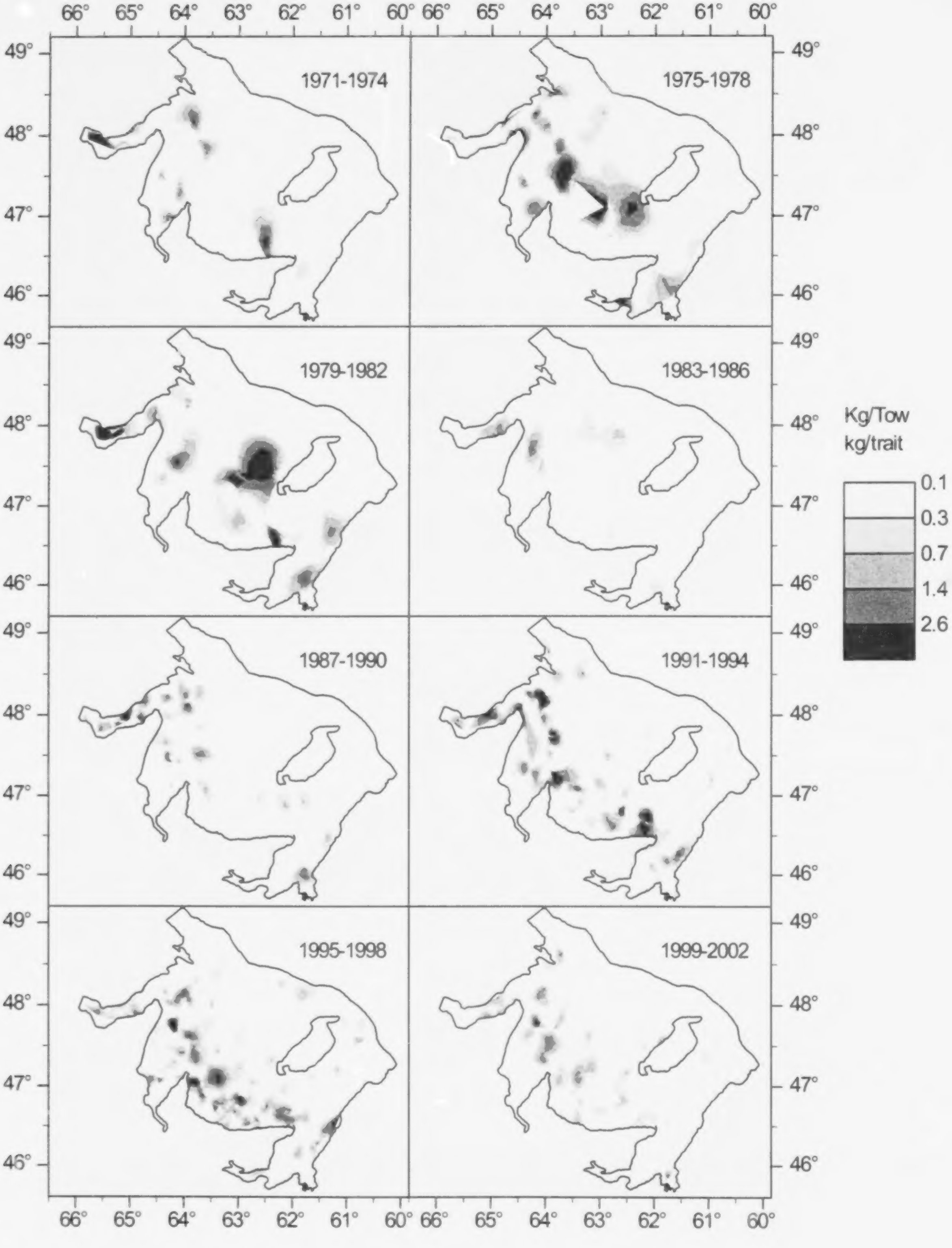

Figure 10a. September distribution of catches (kg) of Greendland Cod, *Gadus ogac*

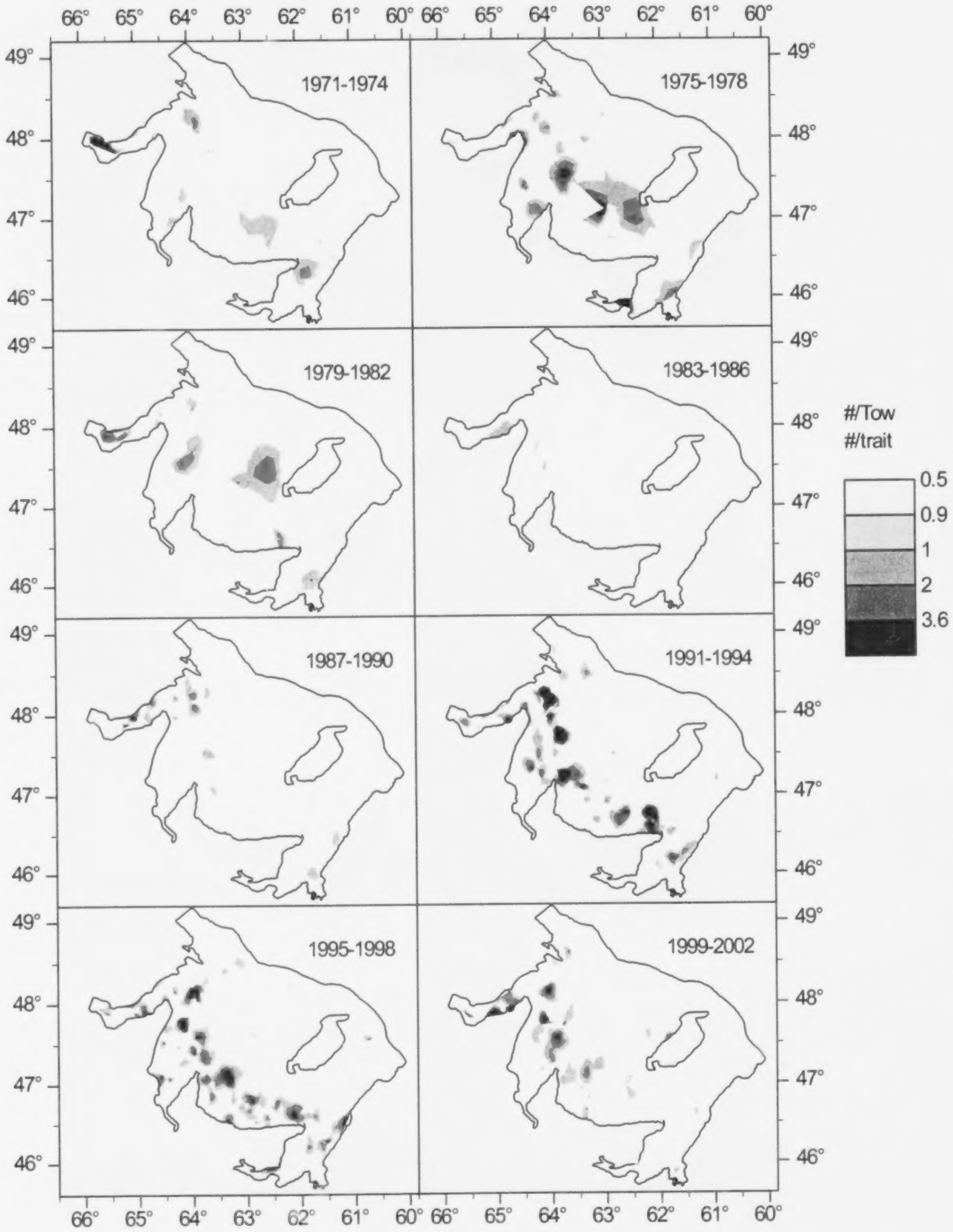

Figure 10b. September distribution of catches (#) of Greendland Cod, *Gadus ogac*

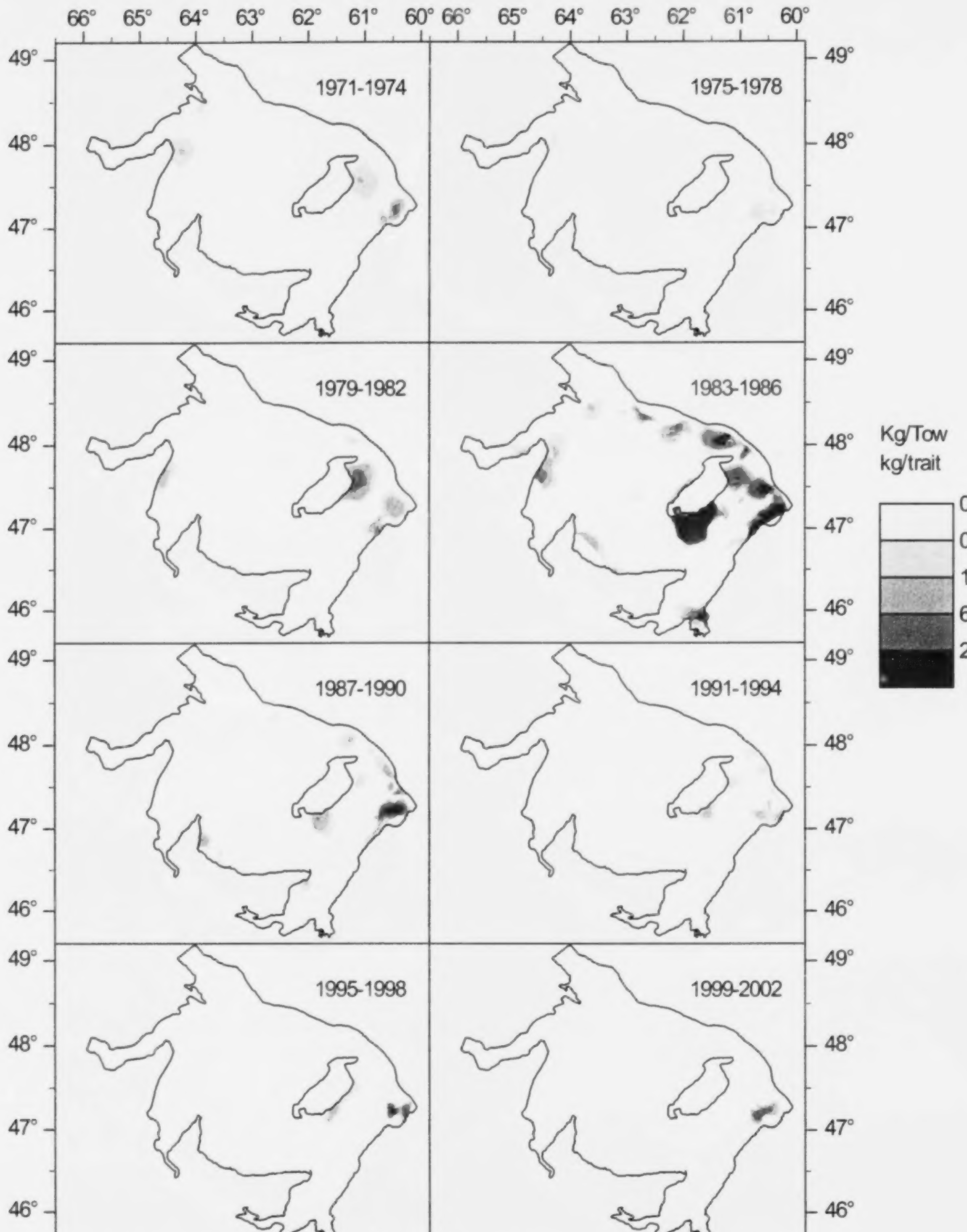

Figure 11a. September distribution of catches (kg) of Haddock, *Melanogrammus aeglefinus*

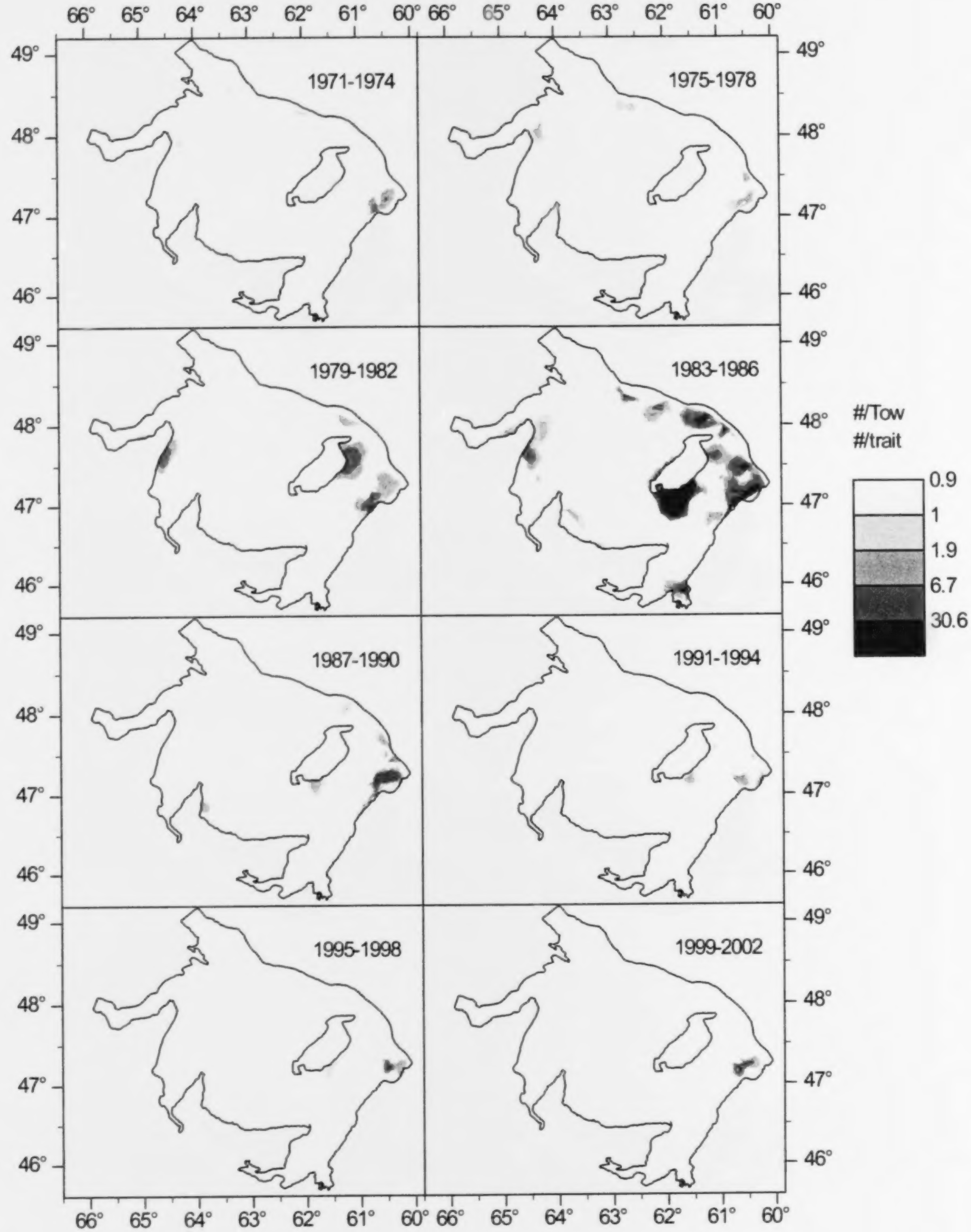

Figure 11b. September distribution of catches (#) of Haddock, *Melanogrammus aeglefinus*

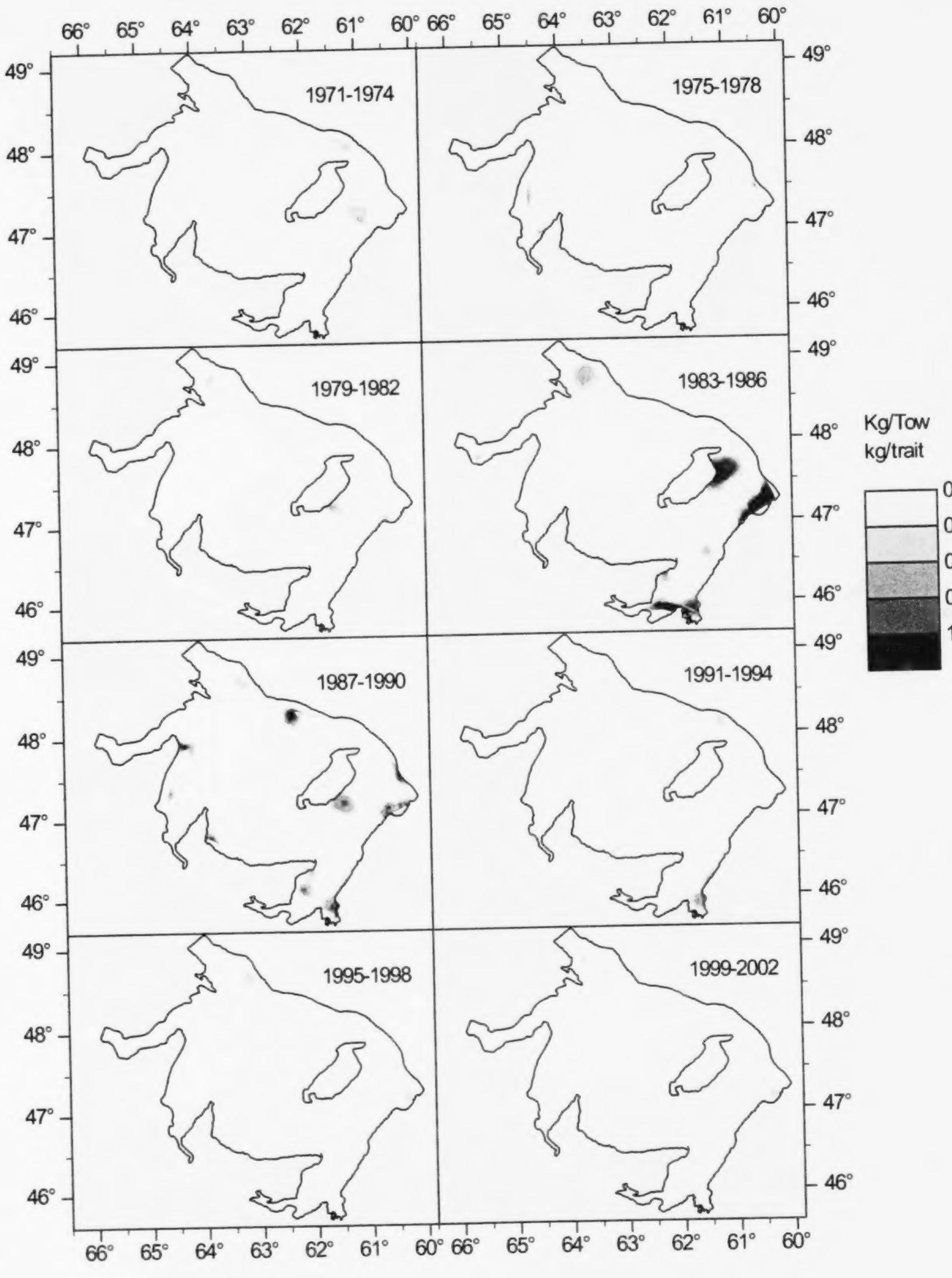

Figure 12a. September distribution of catches (kg) of Silver Hake, *Merluccius bilinearis*

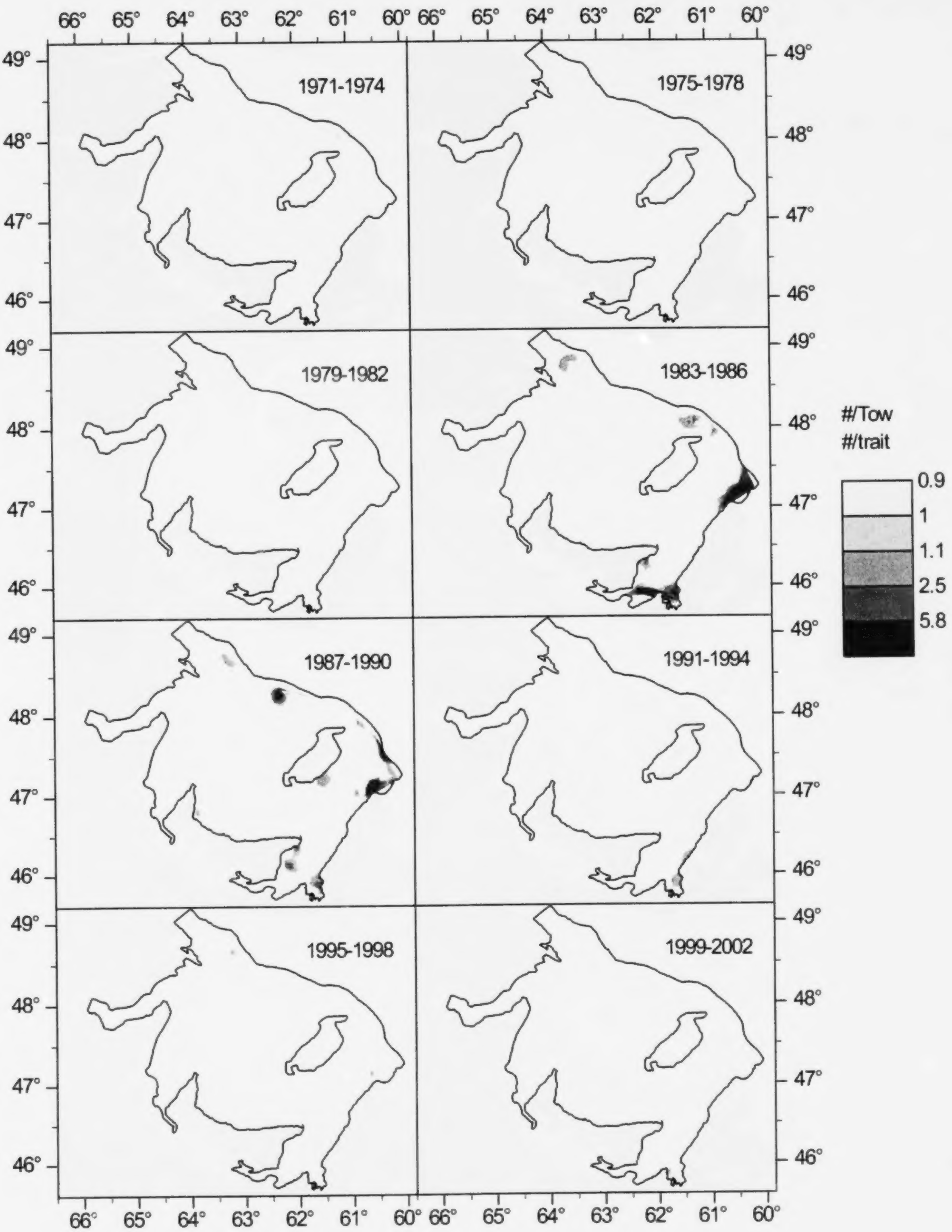

Figure 12b. September distribution of catches (#) of Silver Hake, *Merluccius bilinearis*

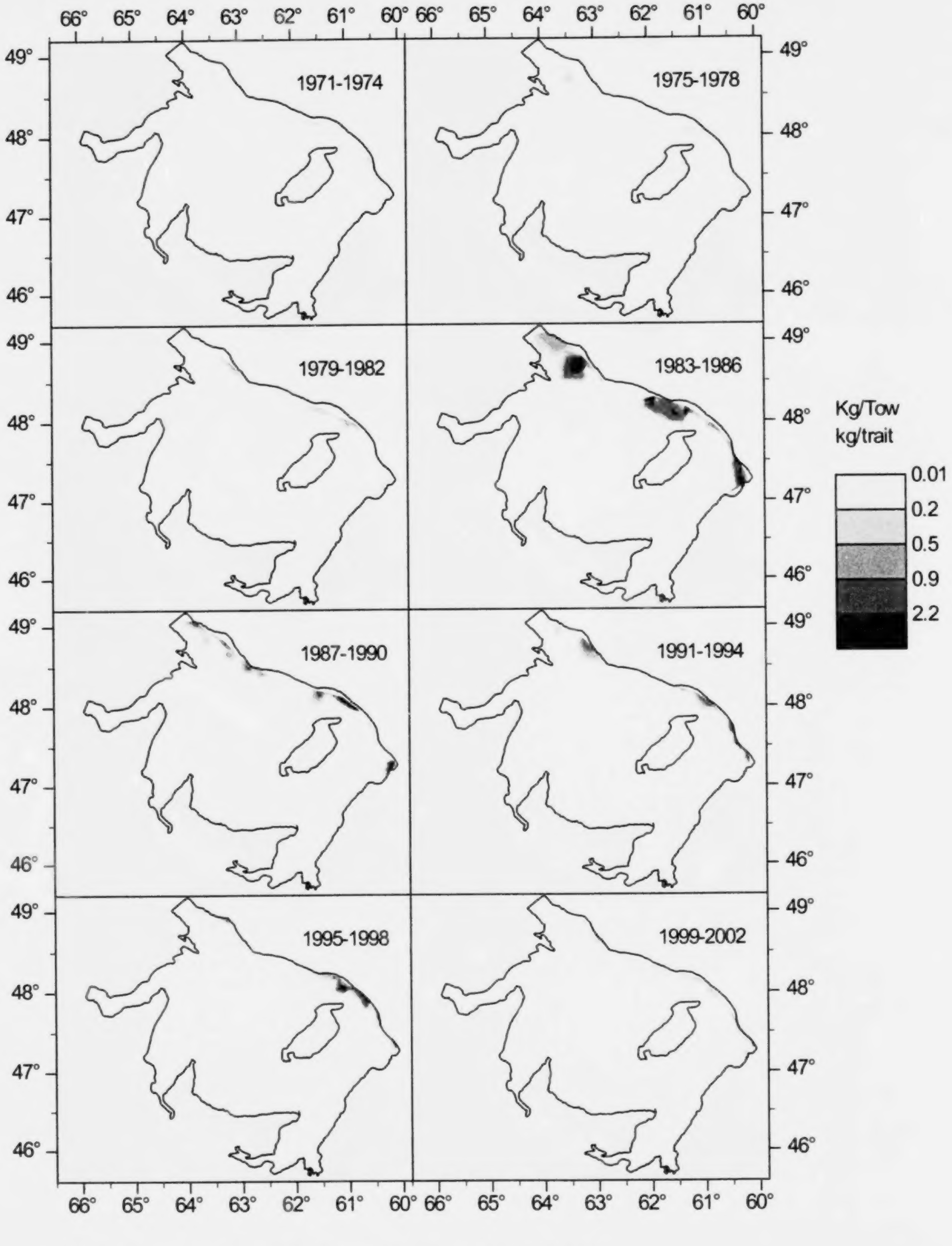

Figure 13a. September distribution of catches (kg) of Longfin Hake, *Phycis chesteri*

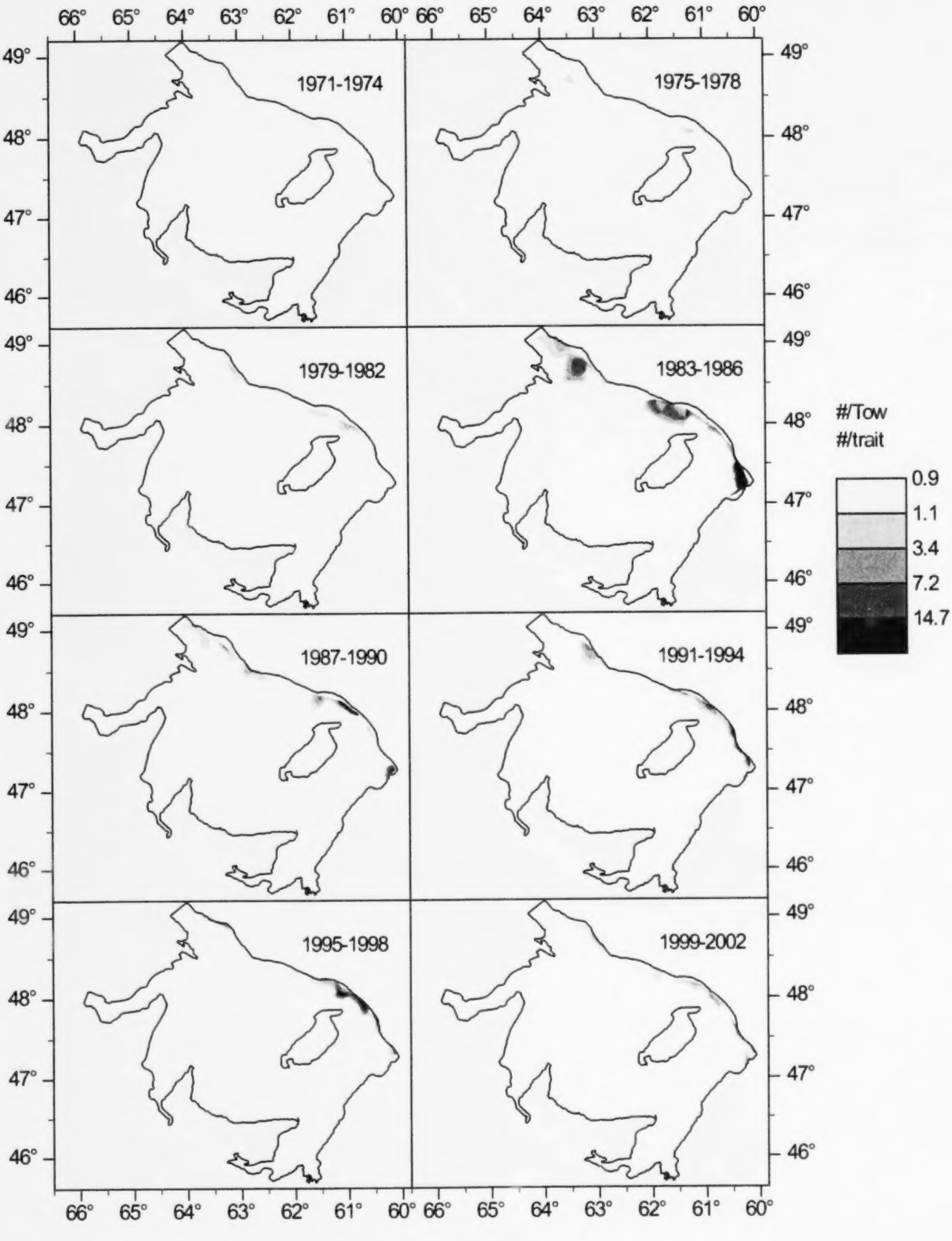

Figure 13b. September distribution of catches (#) of Longfin Hake, *Phycis chesteri*

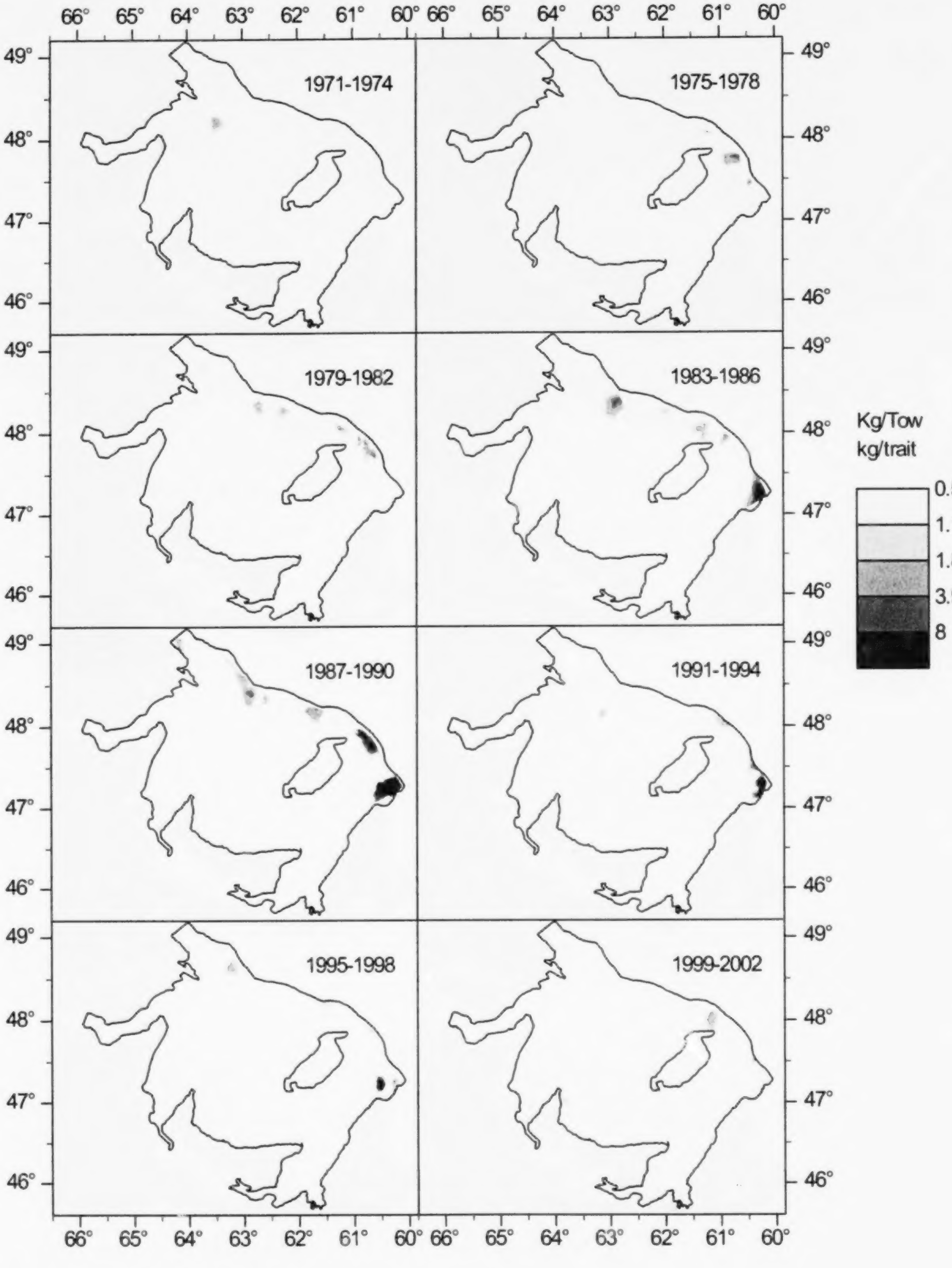

Figure 14a. September distribution of catches (kg) of Pollock, *Pollachius virens*

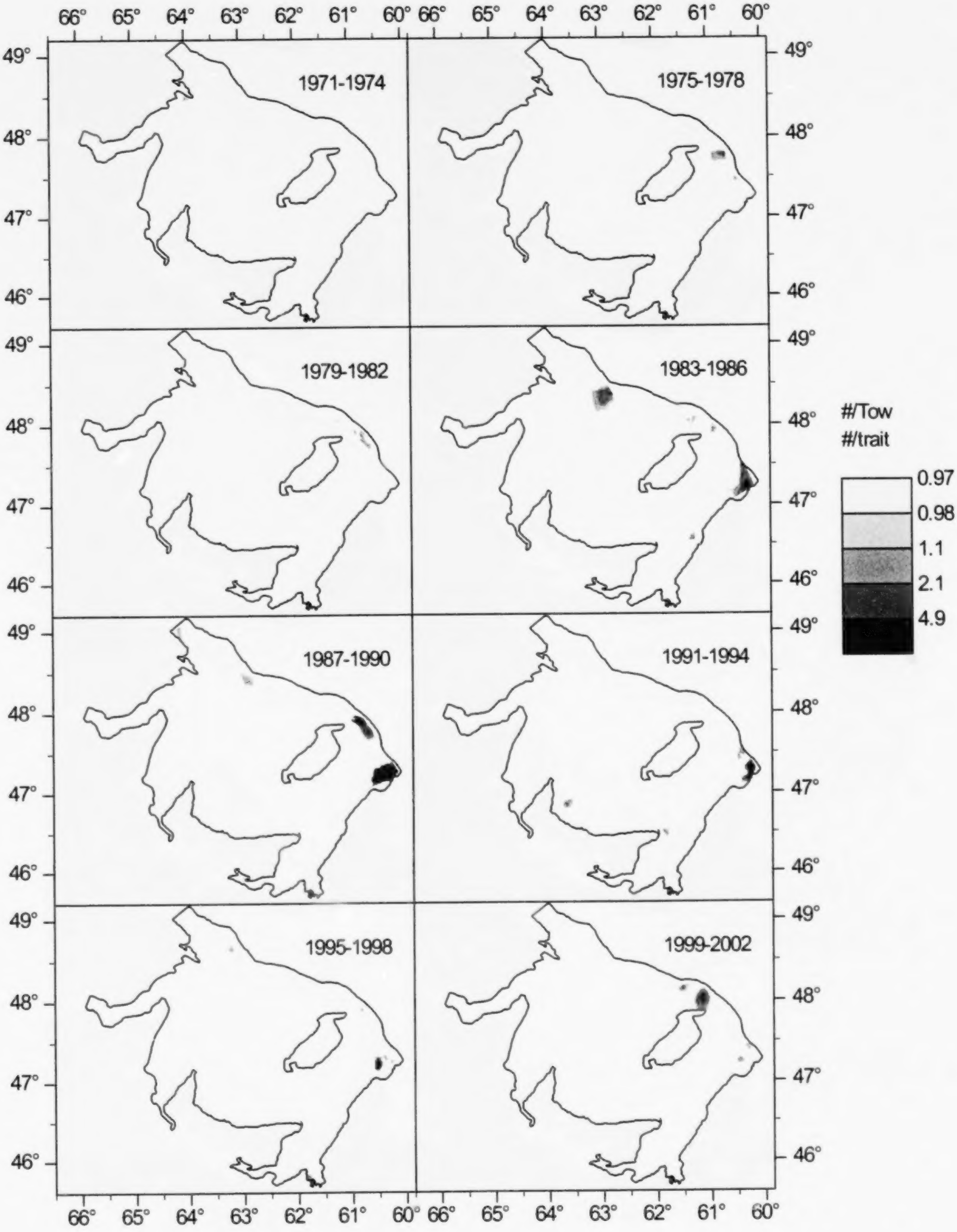

Figure 14b. September distribution of catches (#) of Pollock, *Pollachius virens*

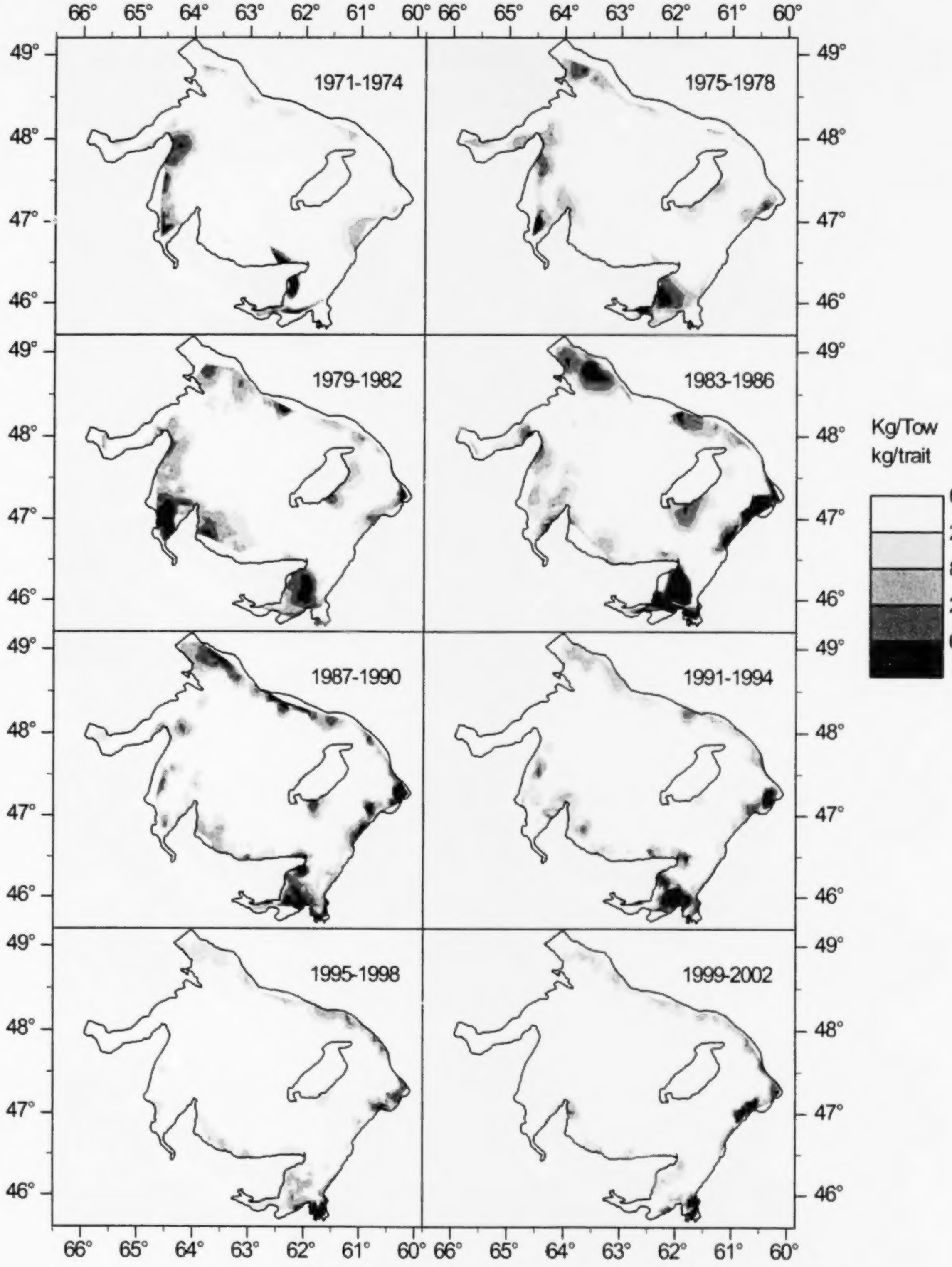

Figure 15a. September distribution of catches (kg) of White Hake, *Urophycis tenuis*

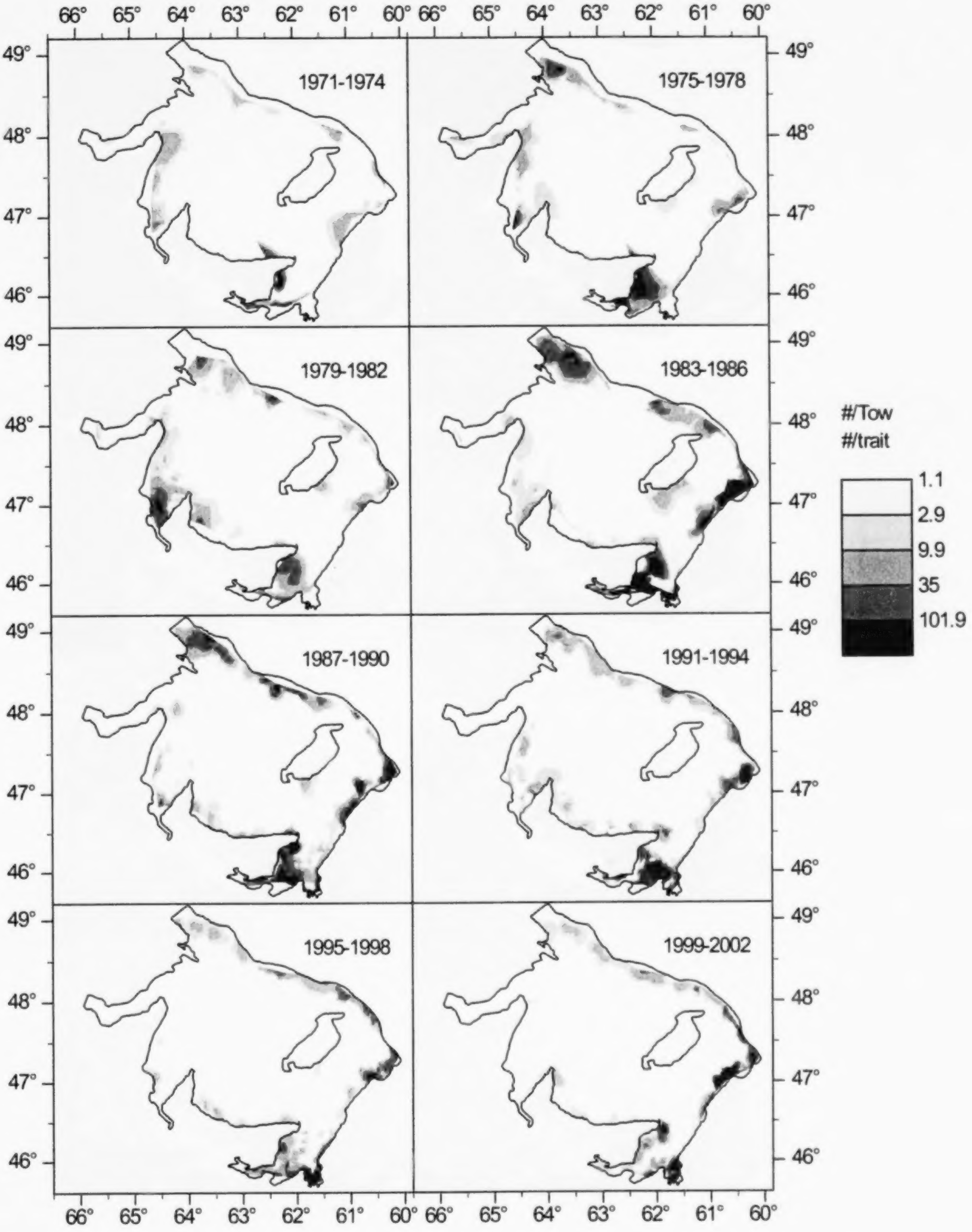

Figure 15b. September distribution of catches (#) of White Hake, *Urophycis tenuis*

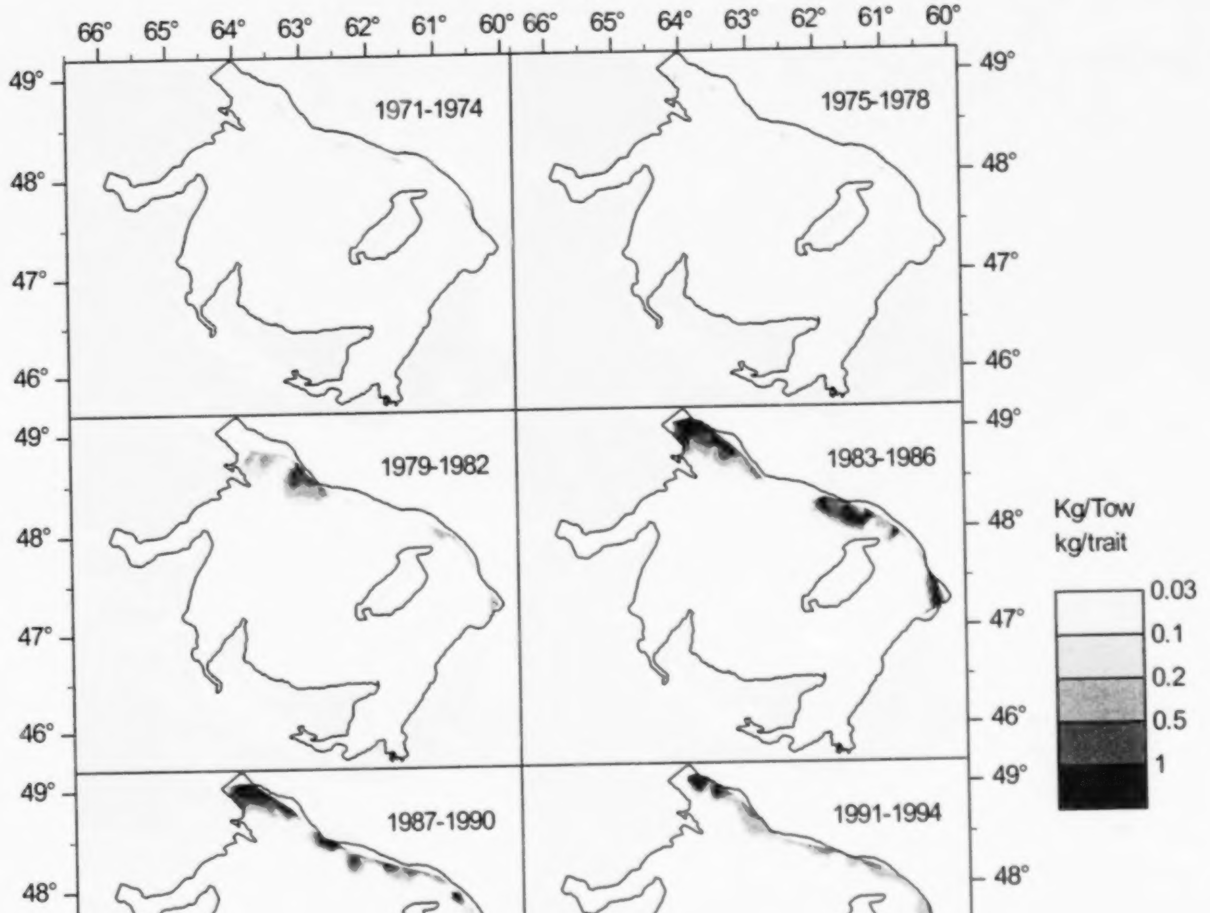

Figure 16a. September distribution of catches (kg) of Marlin-Spike Grenadier, *Nezumia bairdii*

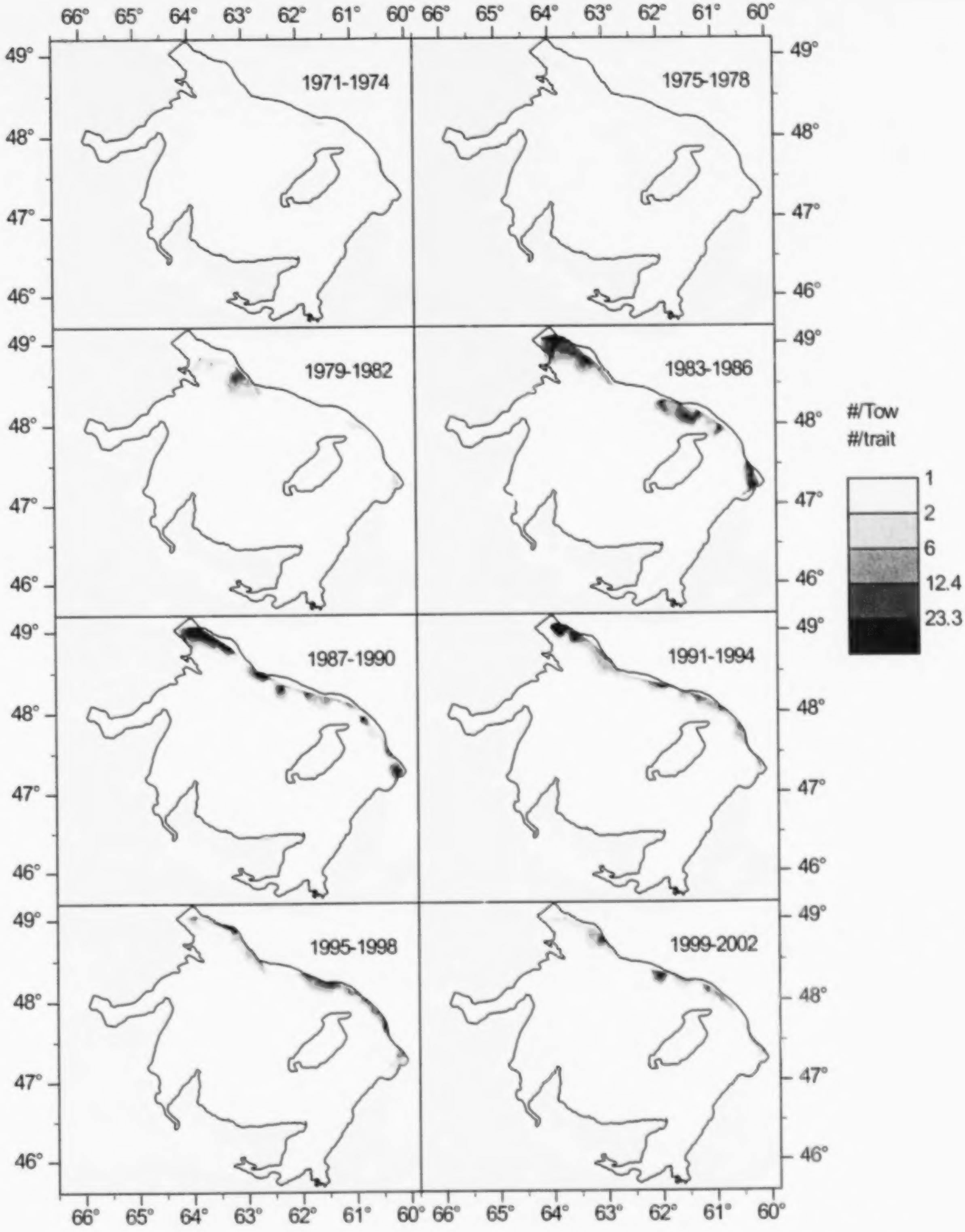

Figure 16b. September distribution of catches (#) of Marlin-Spike Grenadier, *Nezumia bairdii*

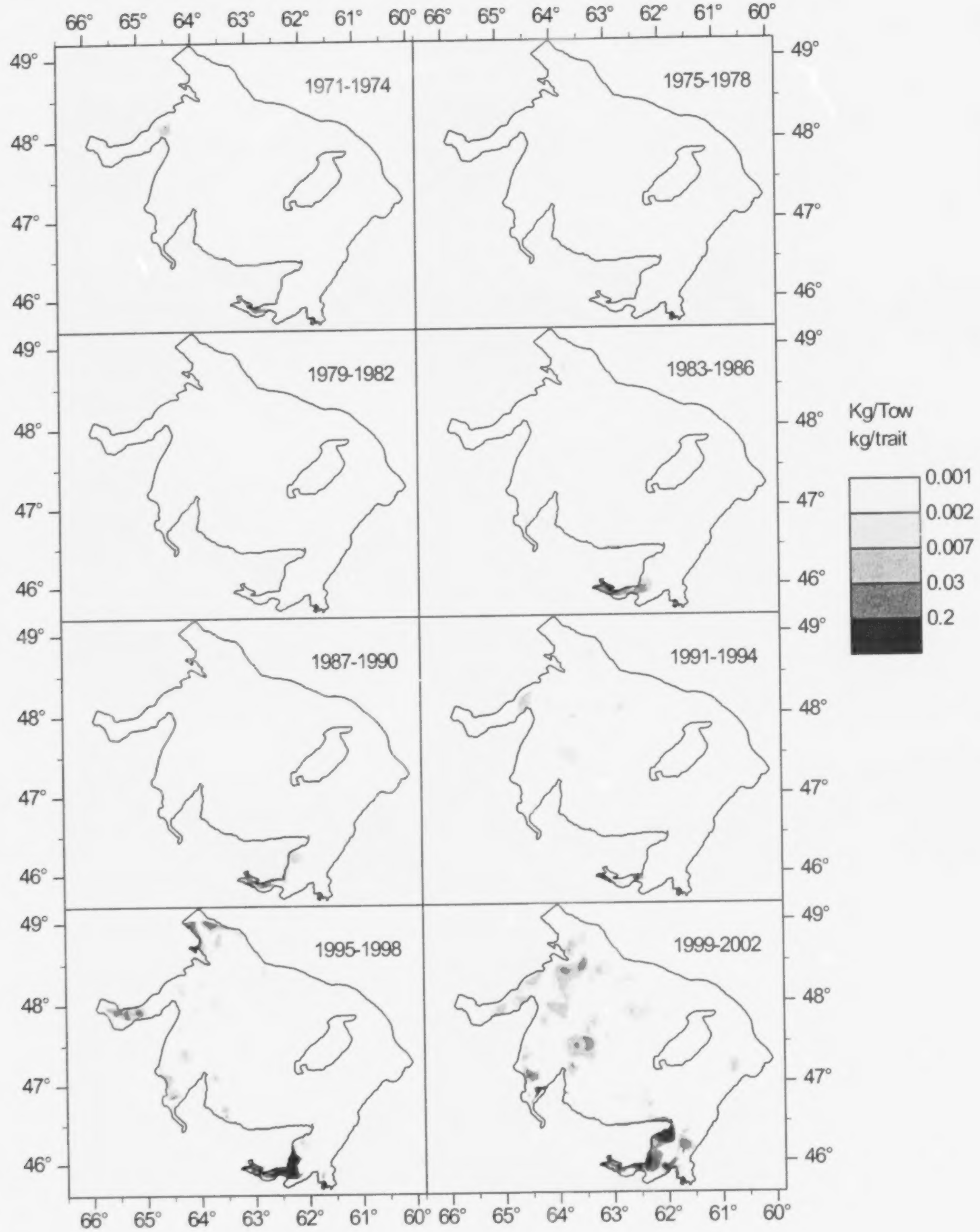

Figure 17a. September distribution of catches (kg) of Threespine Stickleback, *Gasterosteus aculeatus*

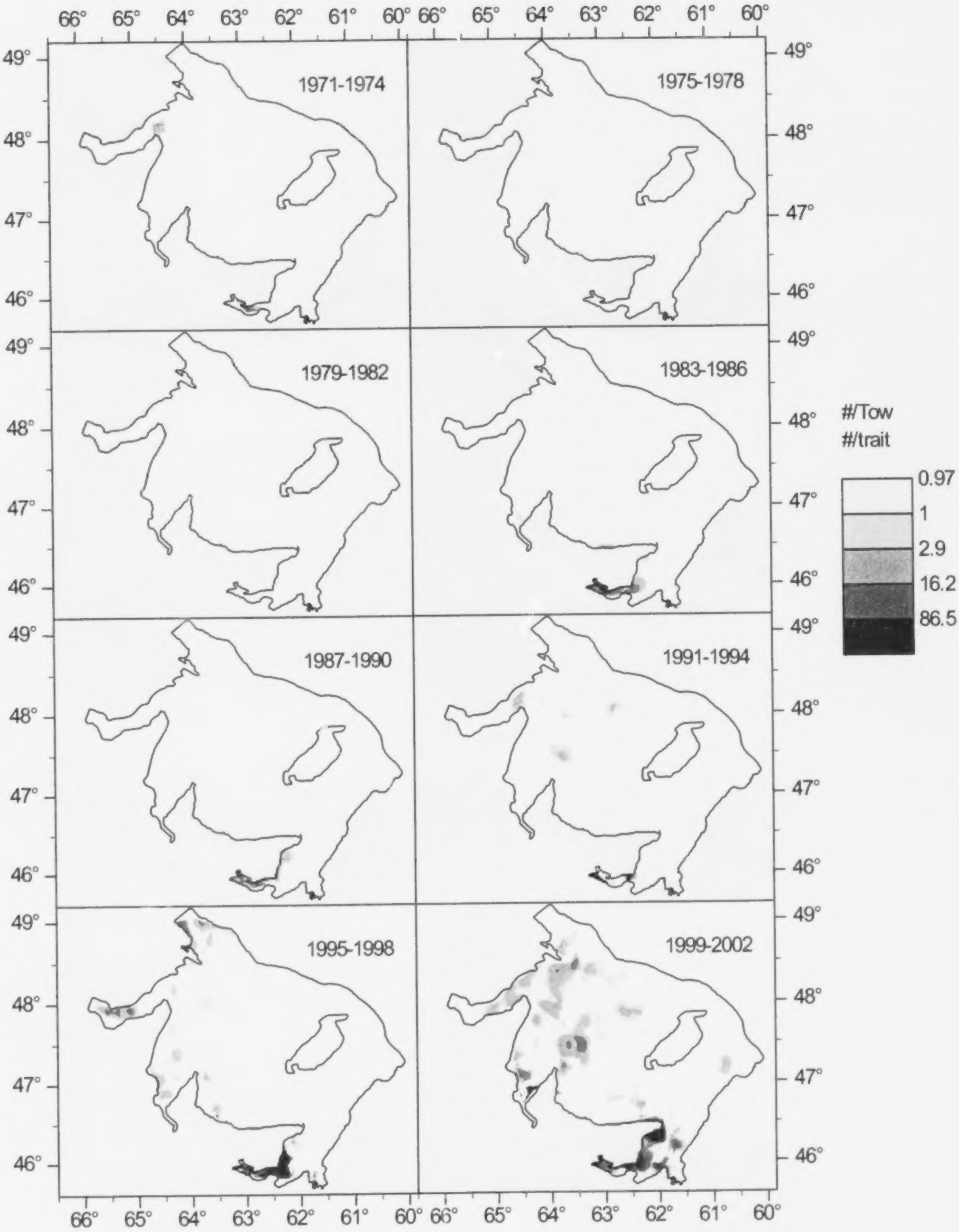

Figure 17b. September distribution of catches (#) of Threespine Stickleback, *Gasterosteus aculeatus*

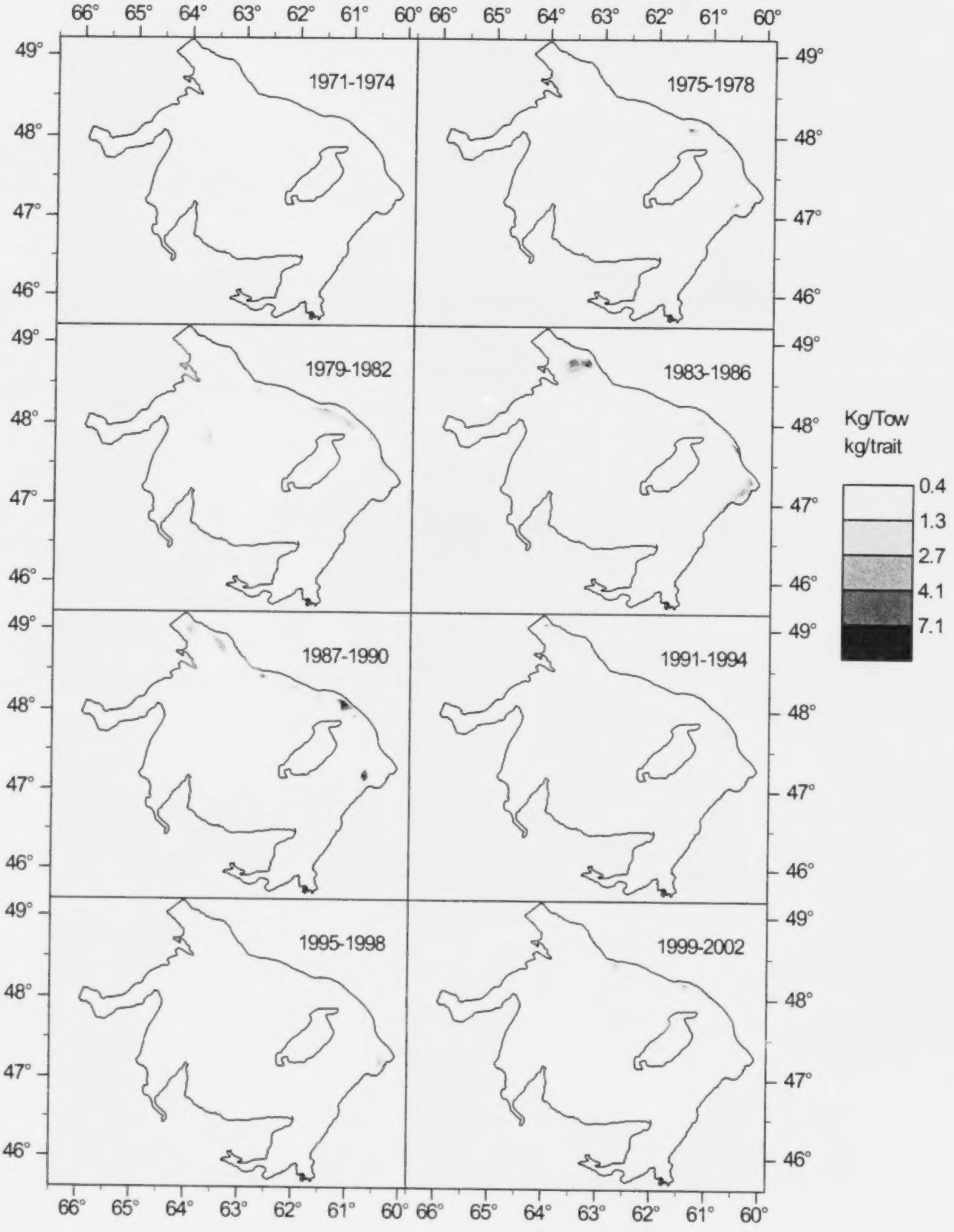

Figure 18a. September distribution of catches (kg) of Monkfish, *Lophius americanus*

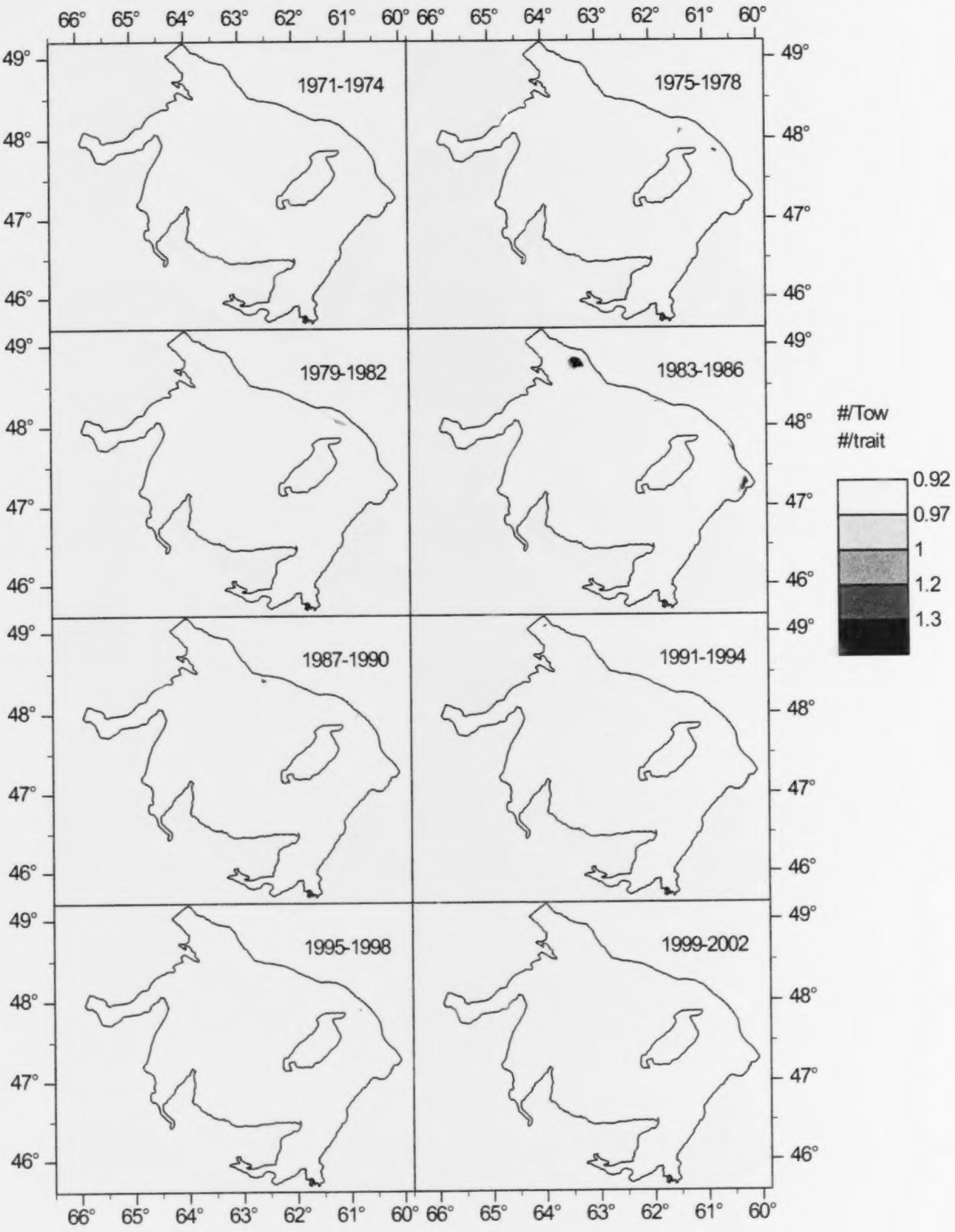

Figure 18b. September distribution of catches (#) of Monkfish, *Lophius americanus*

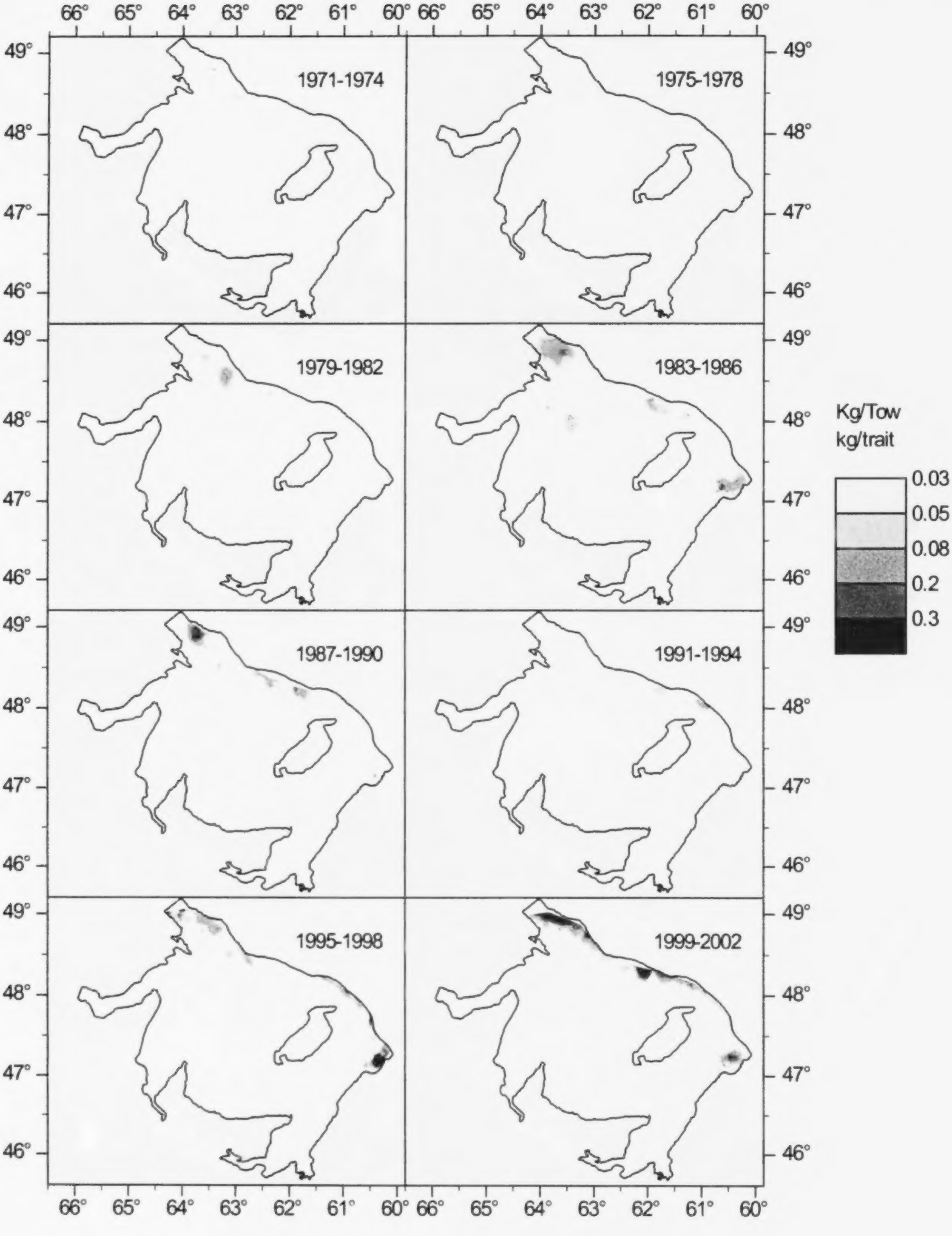

Figure 19a. September distribution of catches (kg) of Northern Hagfish, *Myxine glutinosa*

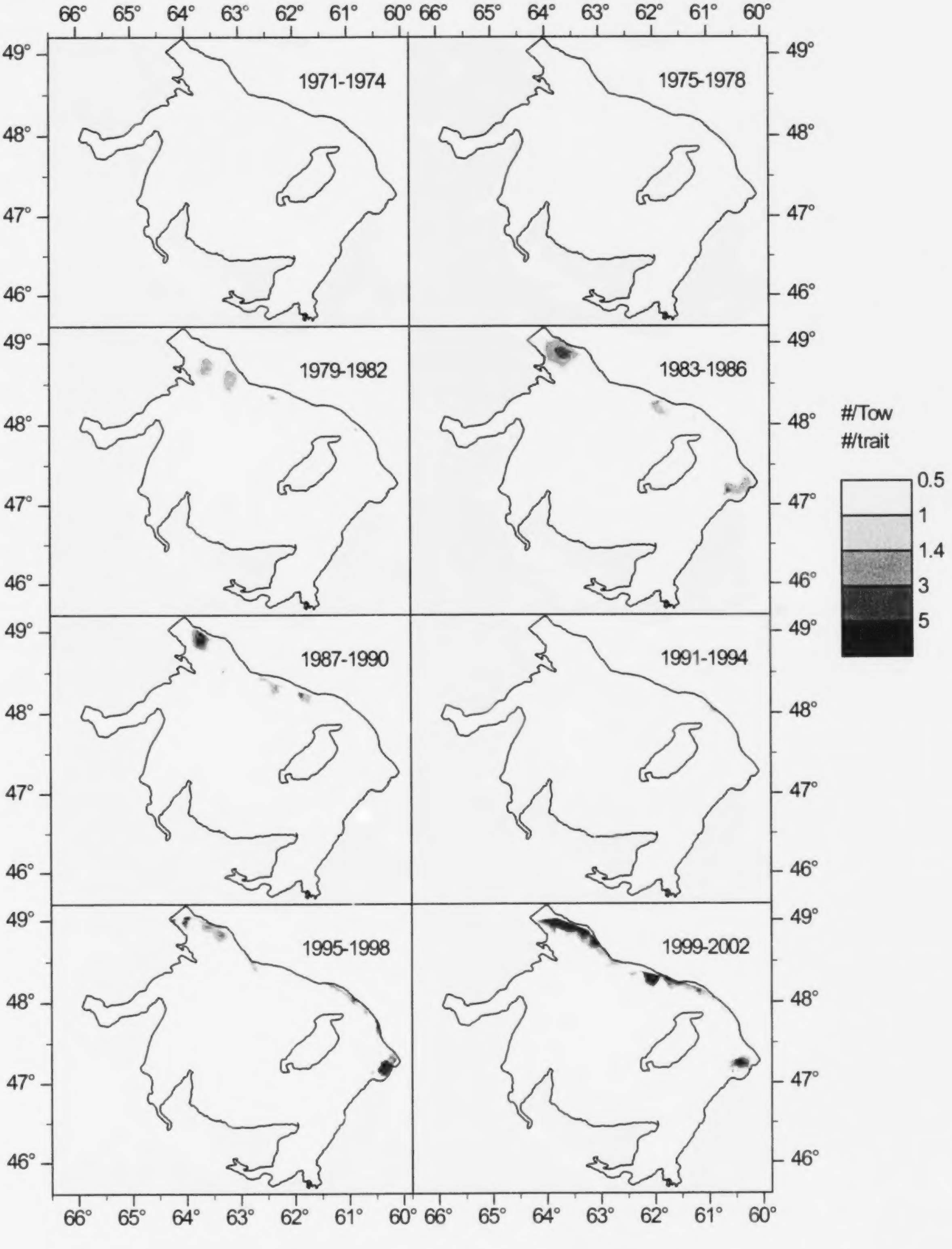

Figure 19b. September distribution of catches (#) of Northern Hagfish, *Myxine glutinosa*

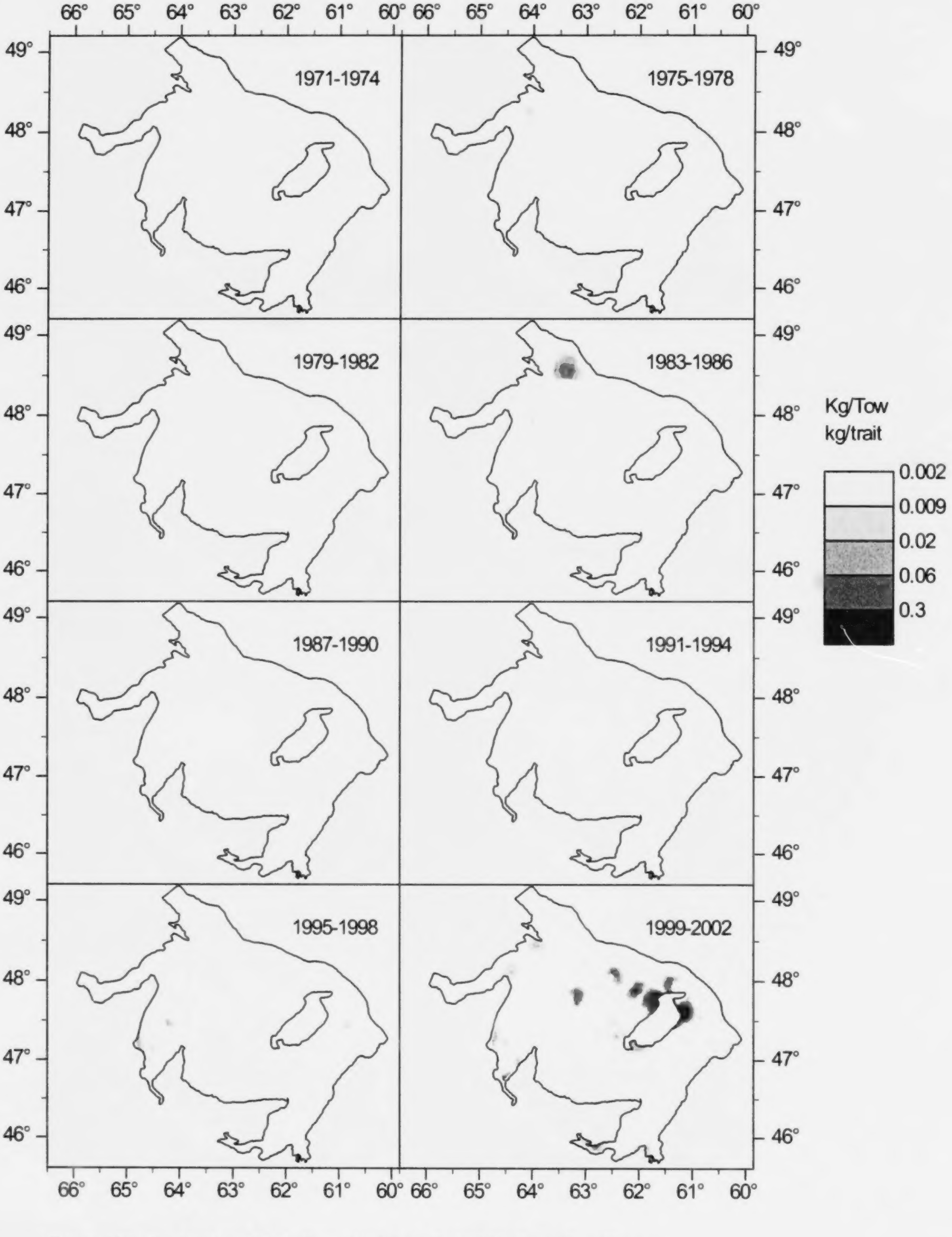

Figure 20a. September distribution of catches (kg) of Northern Sand Lance, *Ammodytes dubius*

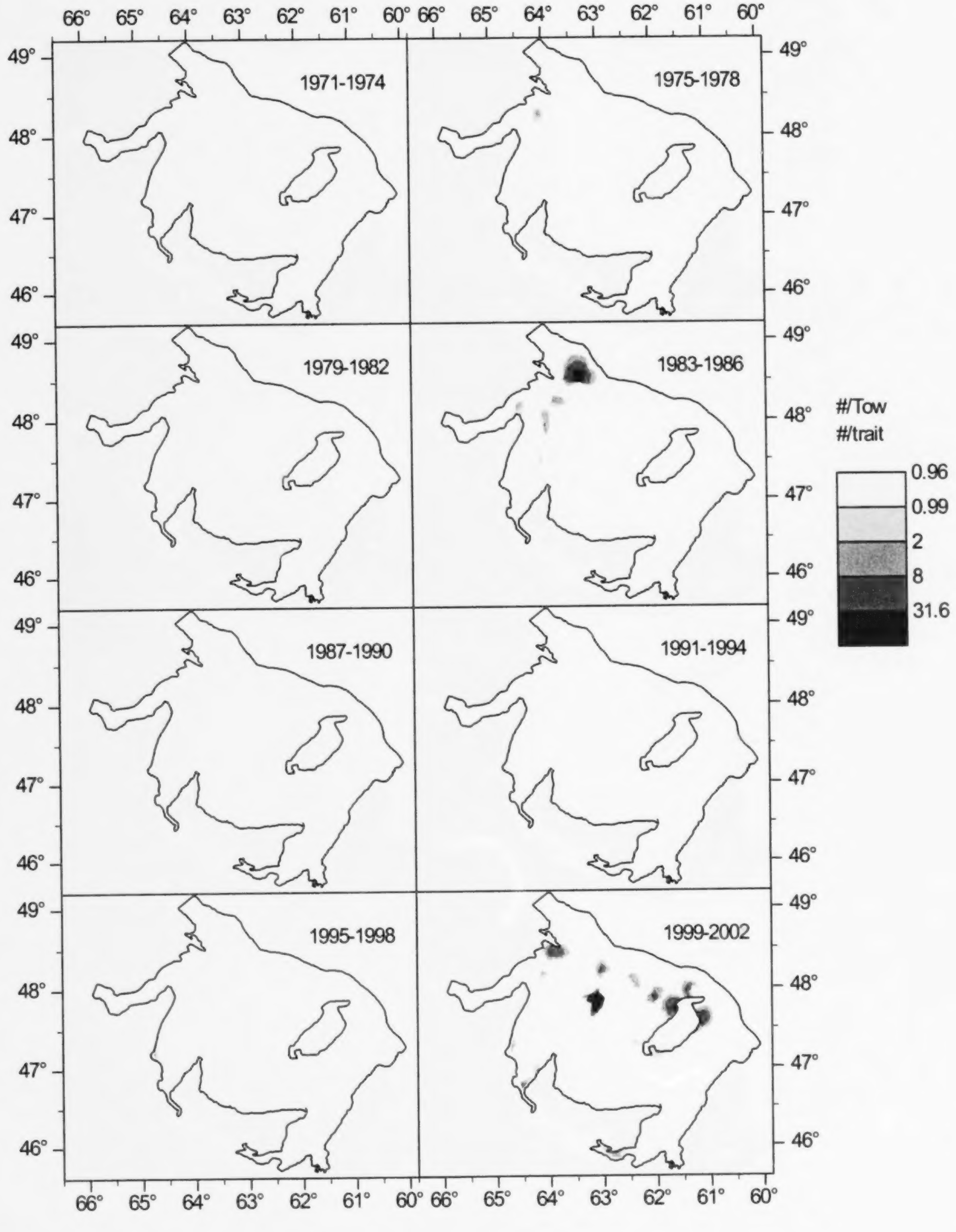

Figure 20b. September distribution of catches (#) of Northern Sand Lance, *Ammodytes dubius*

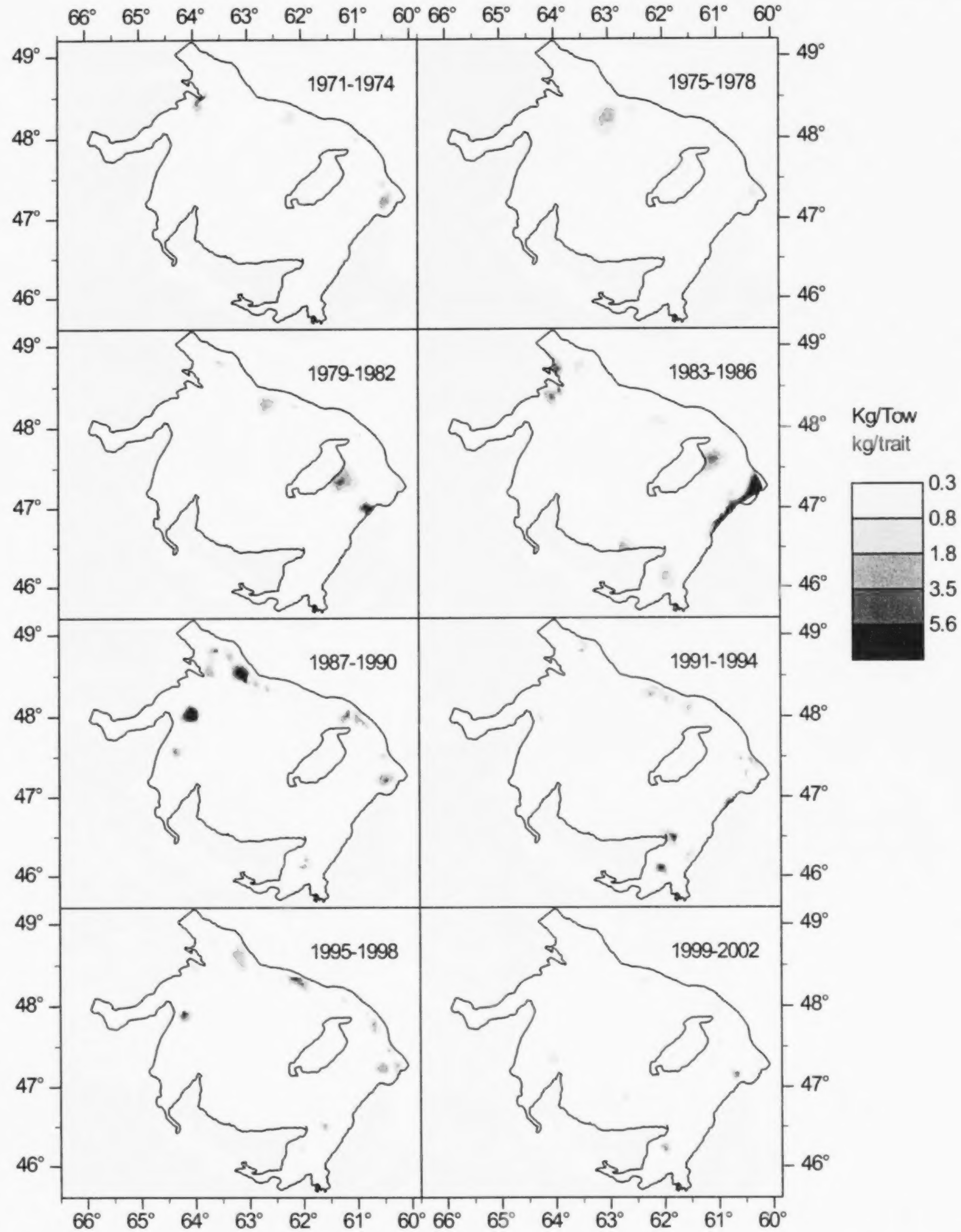

Figure 21a. September distribution of catches (kg) of Atlantic Wolffish, *Anarhichas lupus*

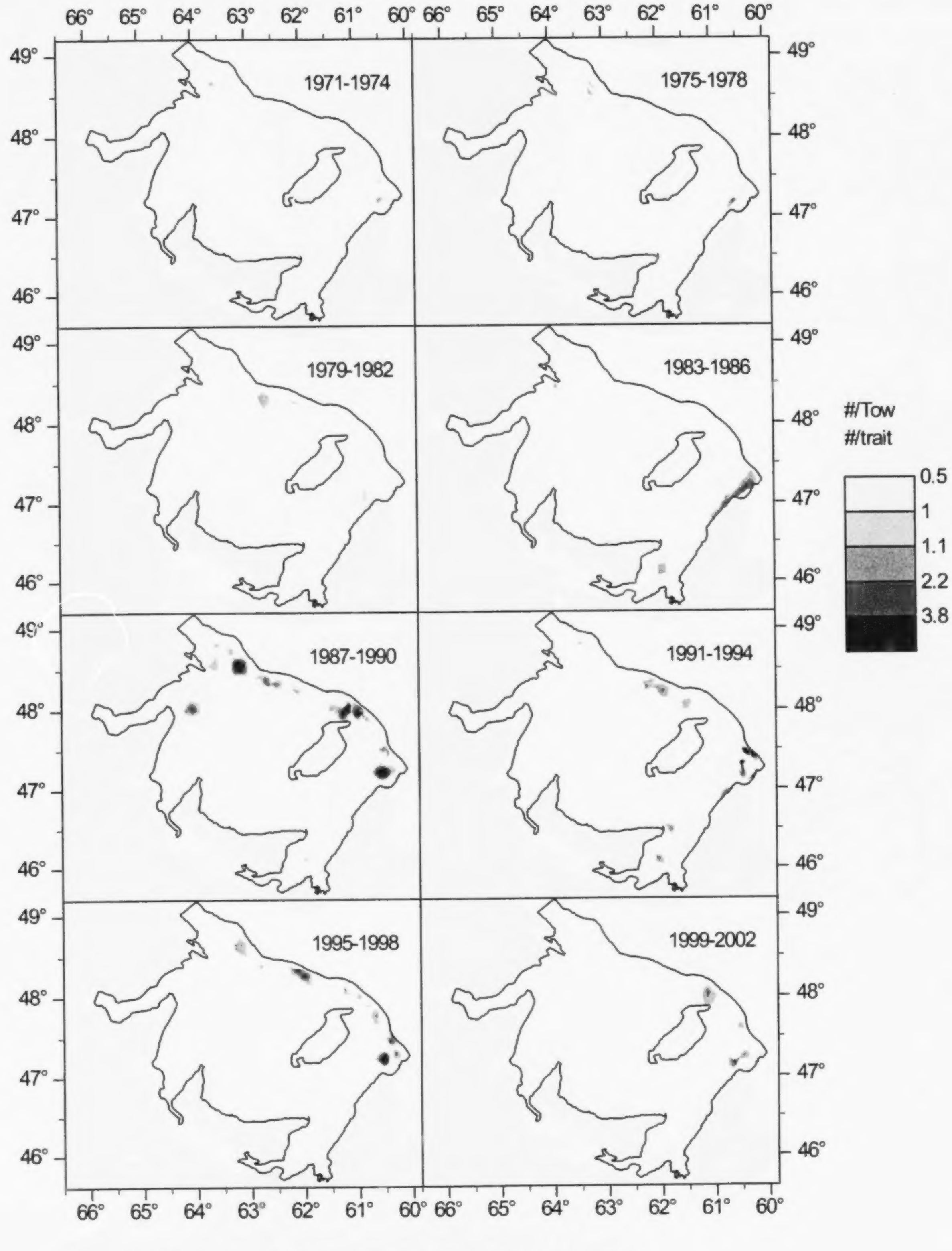

Figure 21b. September distribution of catches (#) of Atlantic Wolffish, *Anarhichas lupus*

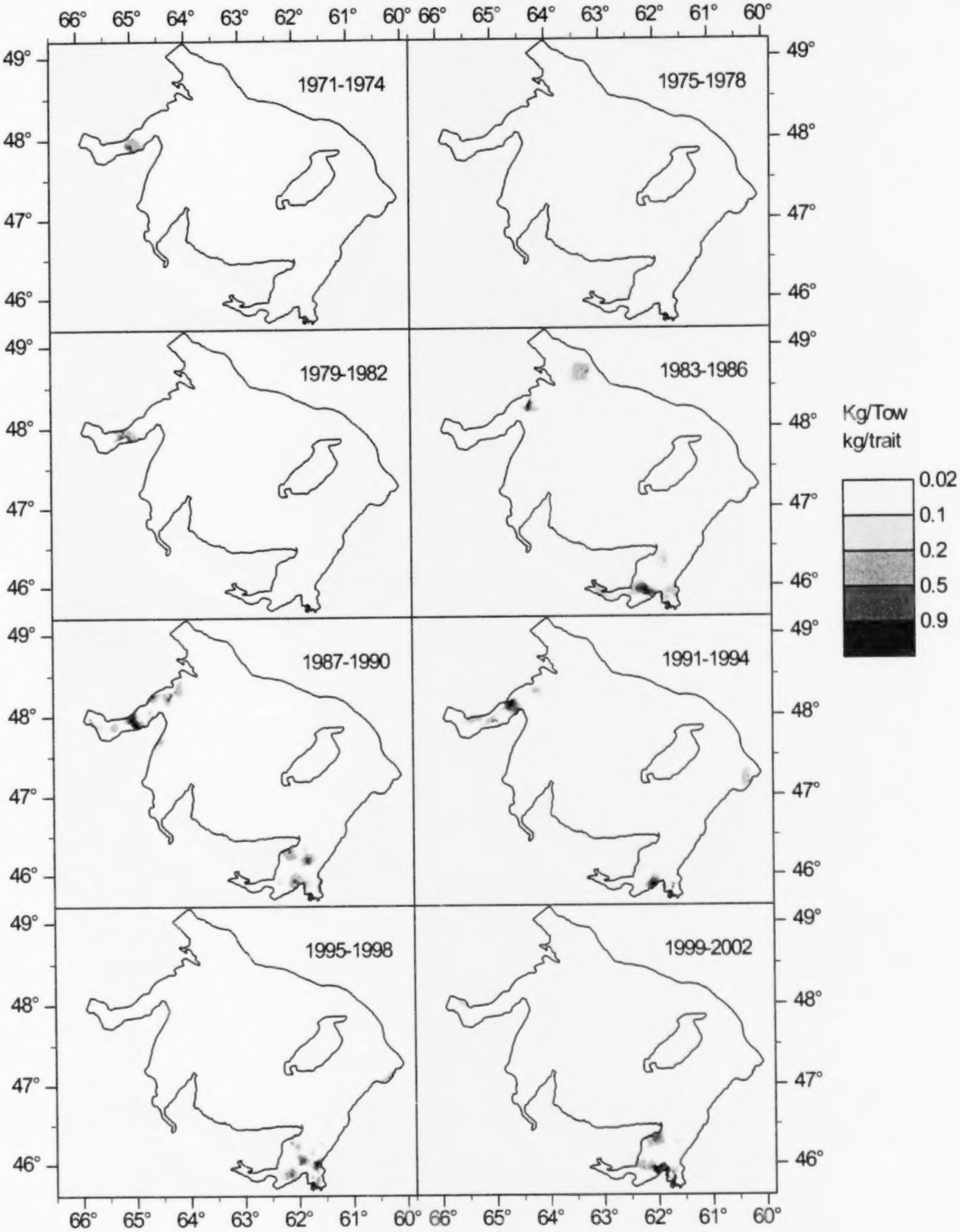

Figure 22a. September distribution of catches (kg) of Wrymouth, *Cryptacanthodes maculatus*

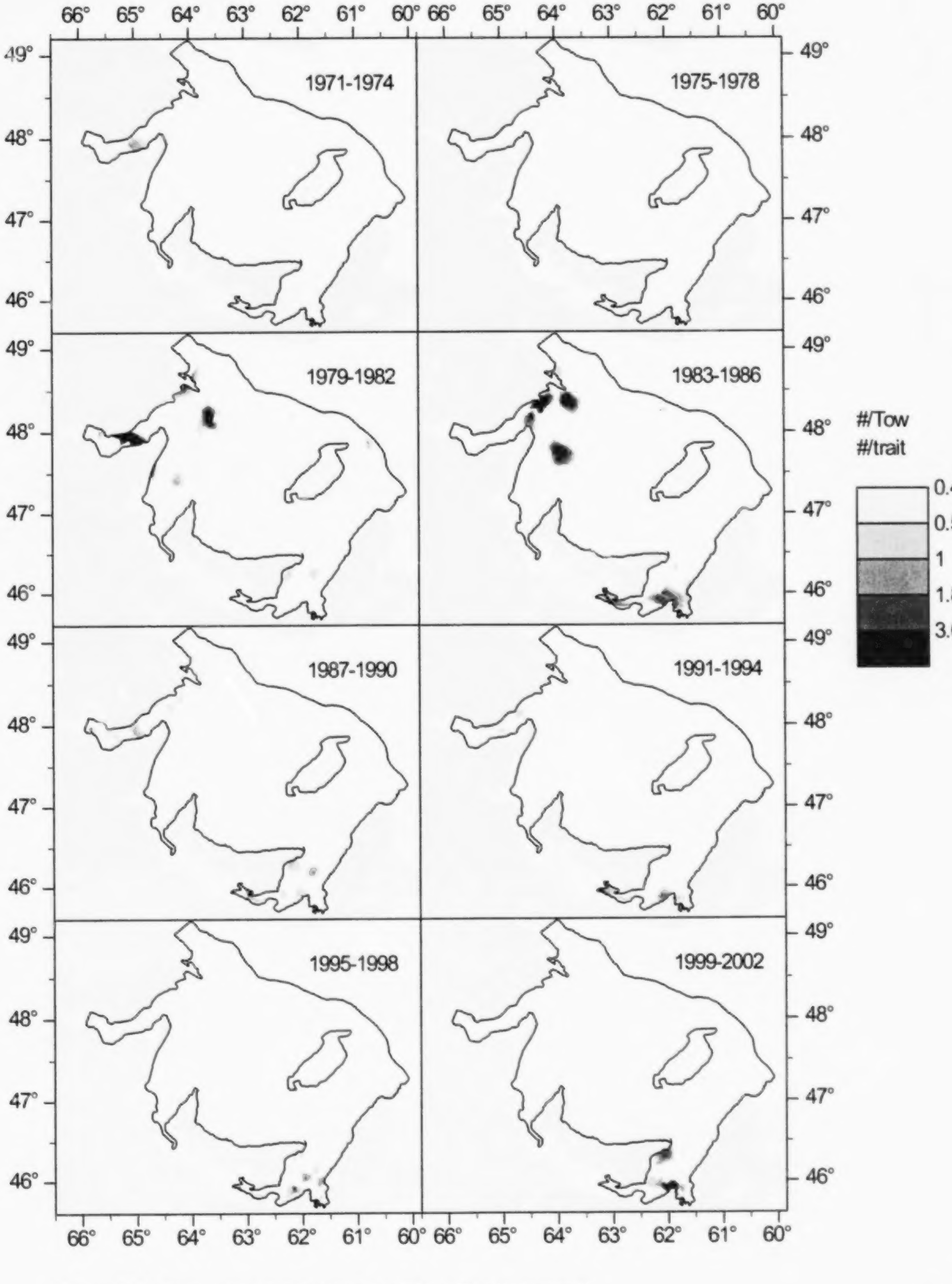

Figure 22b. September distribution of catches (#) of Wrymouth, *Cryptacanthodes maculatus*

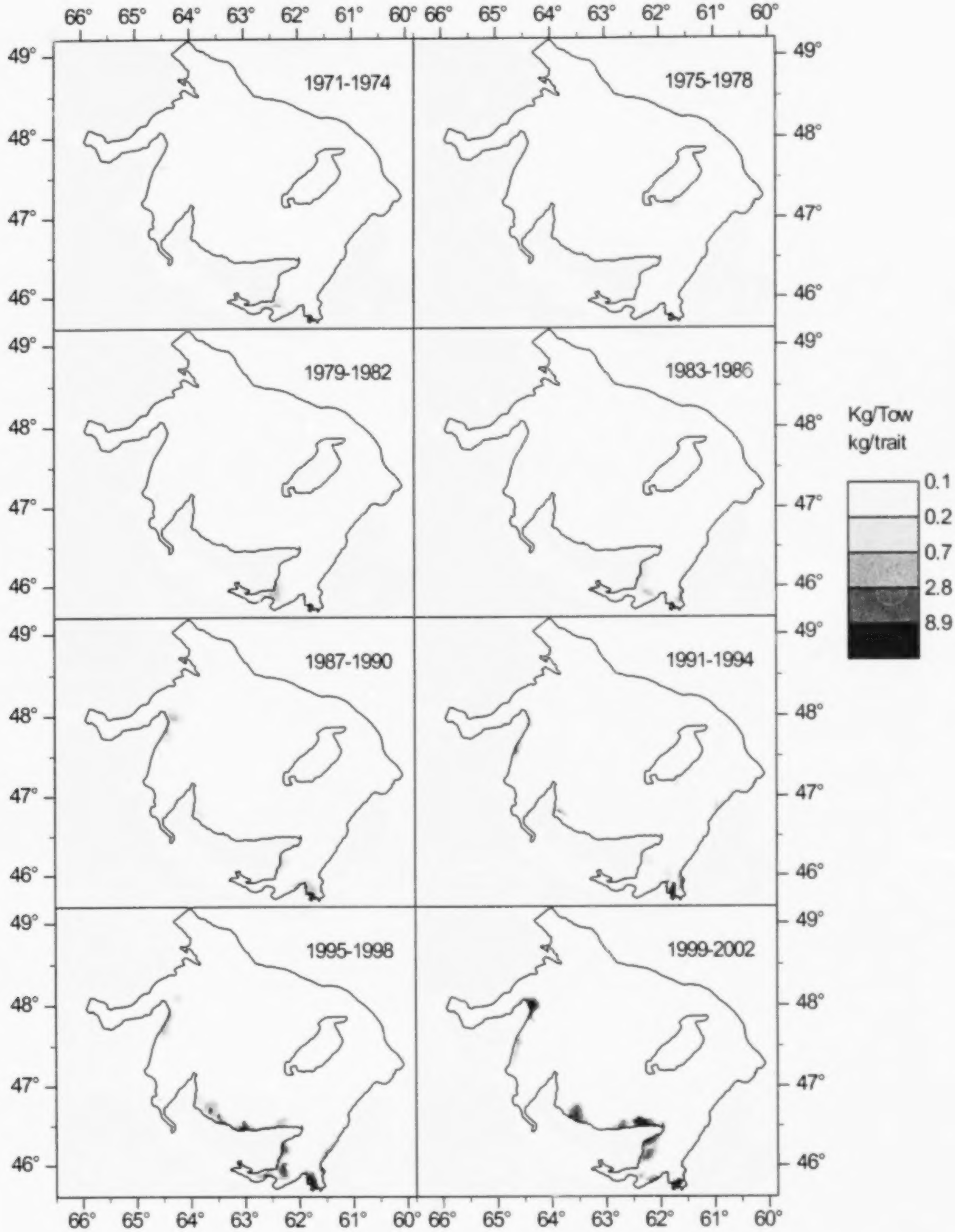

Figure 23a. September distribution of catches (kg) of Cunner, *Tautogolabrus adspersus*

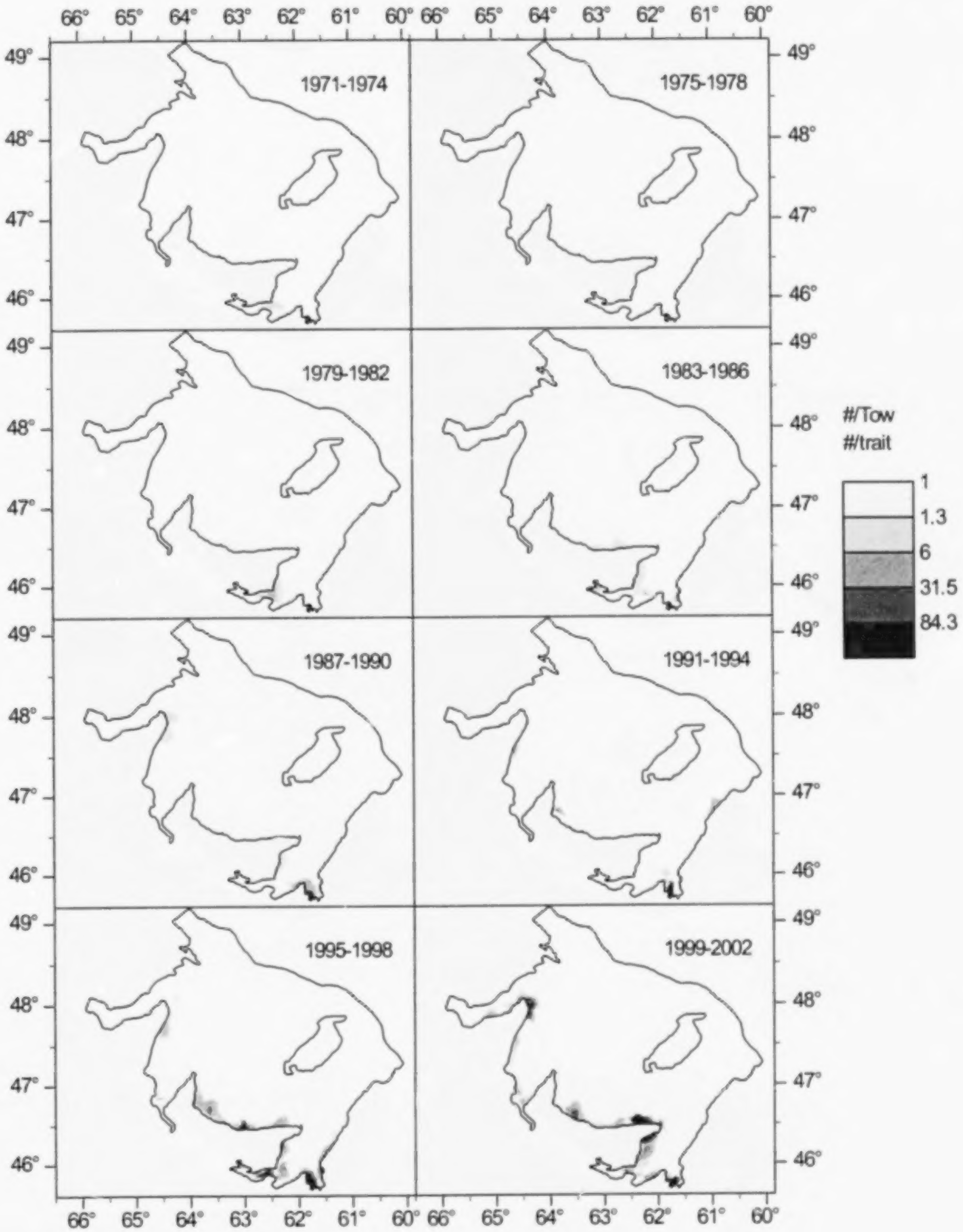

Figure 23b. September distribution of catches (#) of Cunner, *Tautogolabrus adspersus*

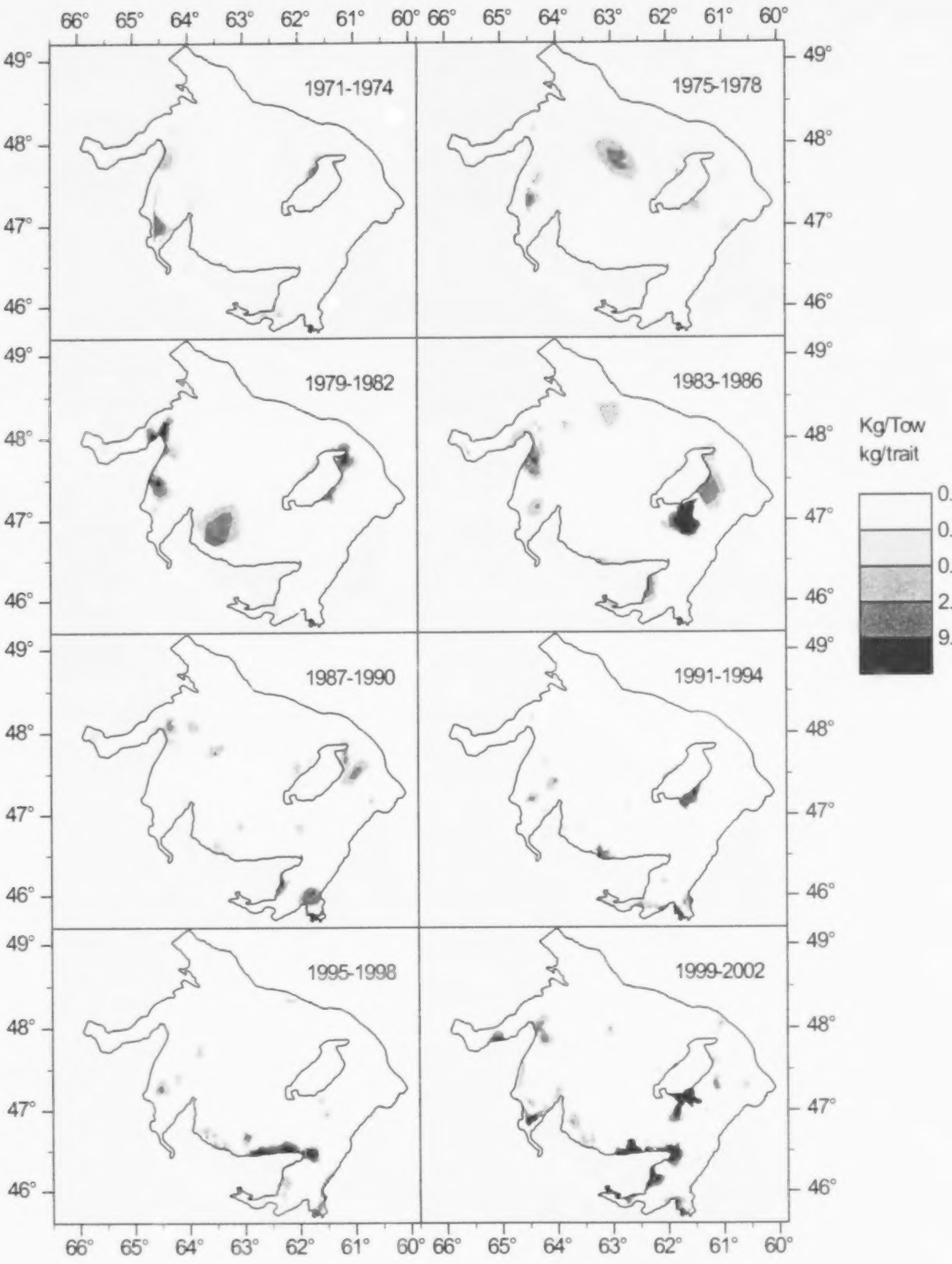

Figure 24a. September distribution of catches (kg) of Atlantic Mackerel, *Scomber scombrus*

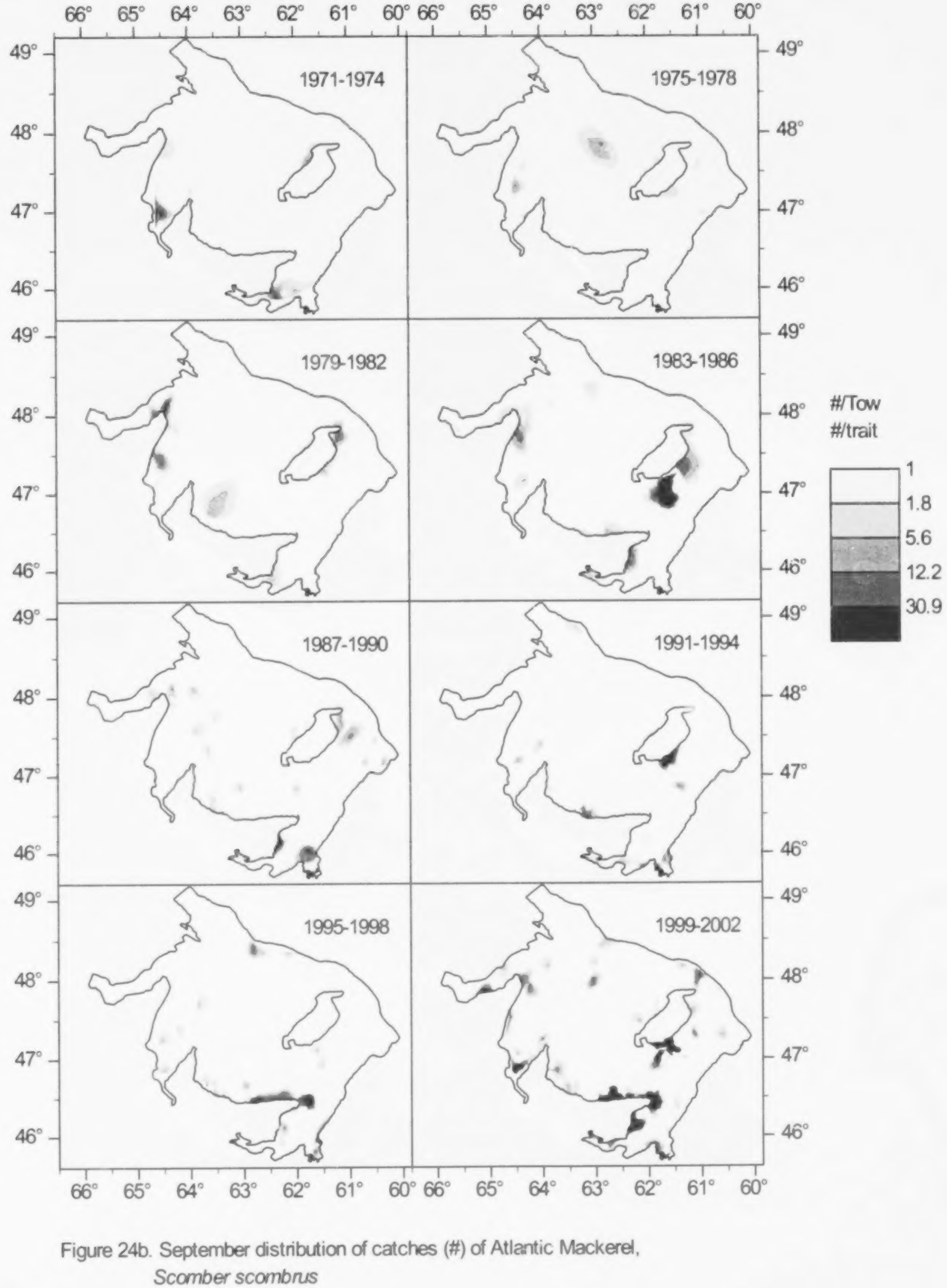

Figure 24b. September distribution of catches (#) of Atlantic Mackerel, *Scomber scombrus*

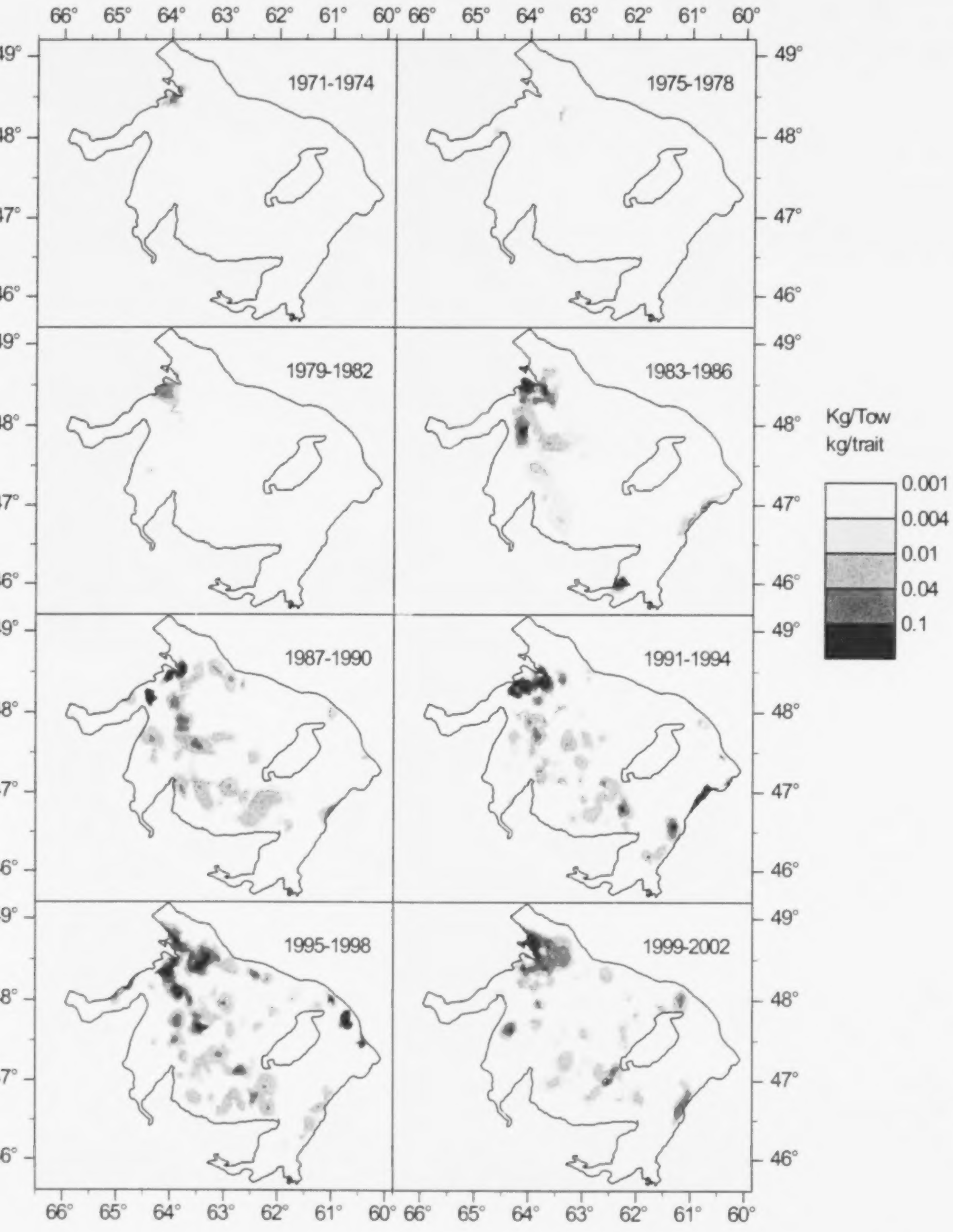

Figure 25a. September distribution of catches (kg) of Fourline Snakeblenny, *Eumesogrammus praecisus*

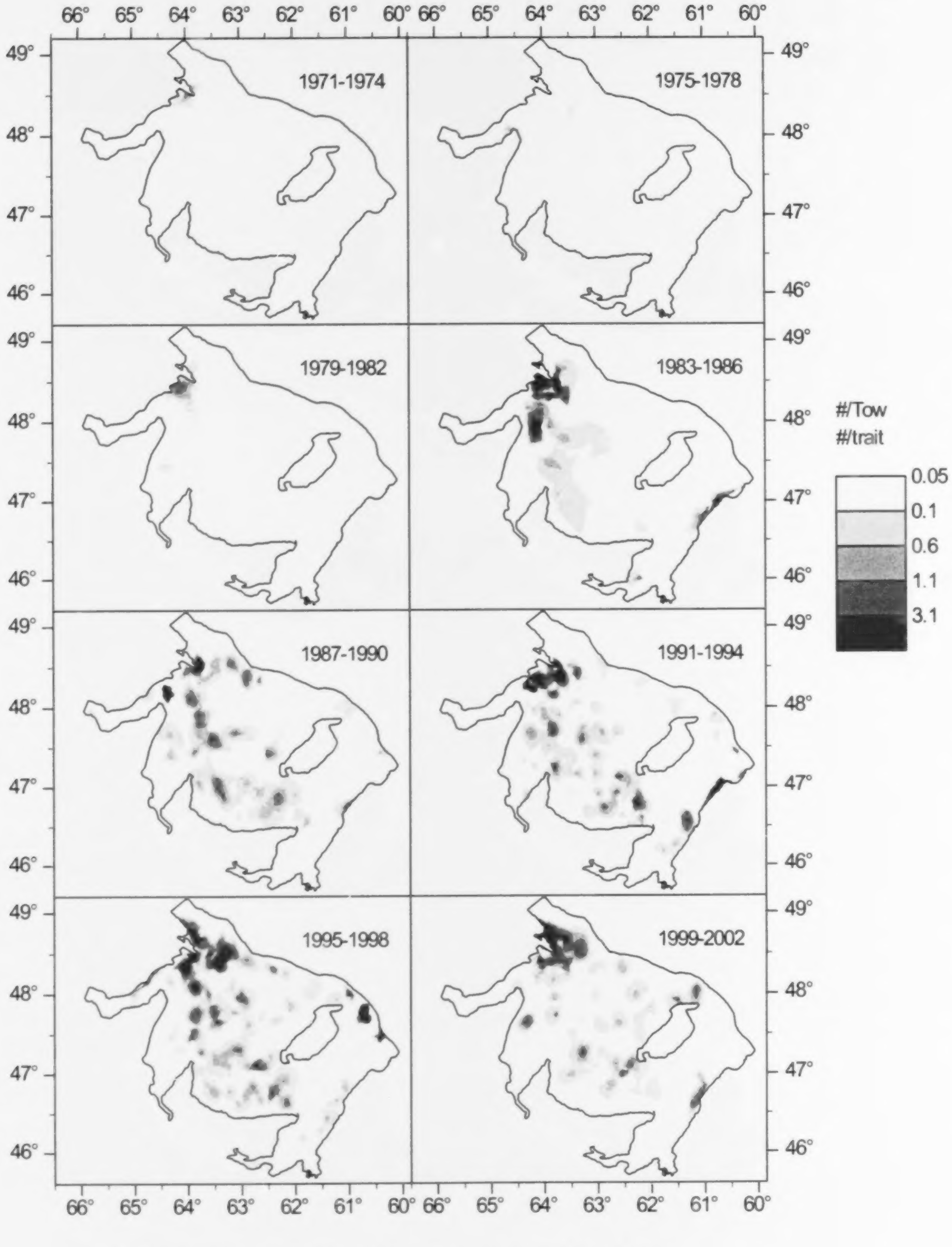

Figure 25b. September distribution of catches (#) of Fourline Snakeblenny, *Eumesogrammus praecisus*

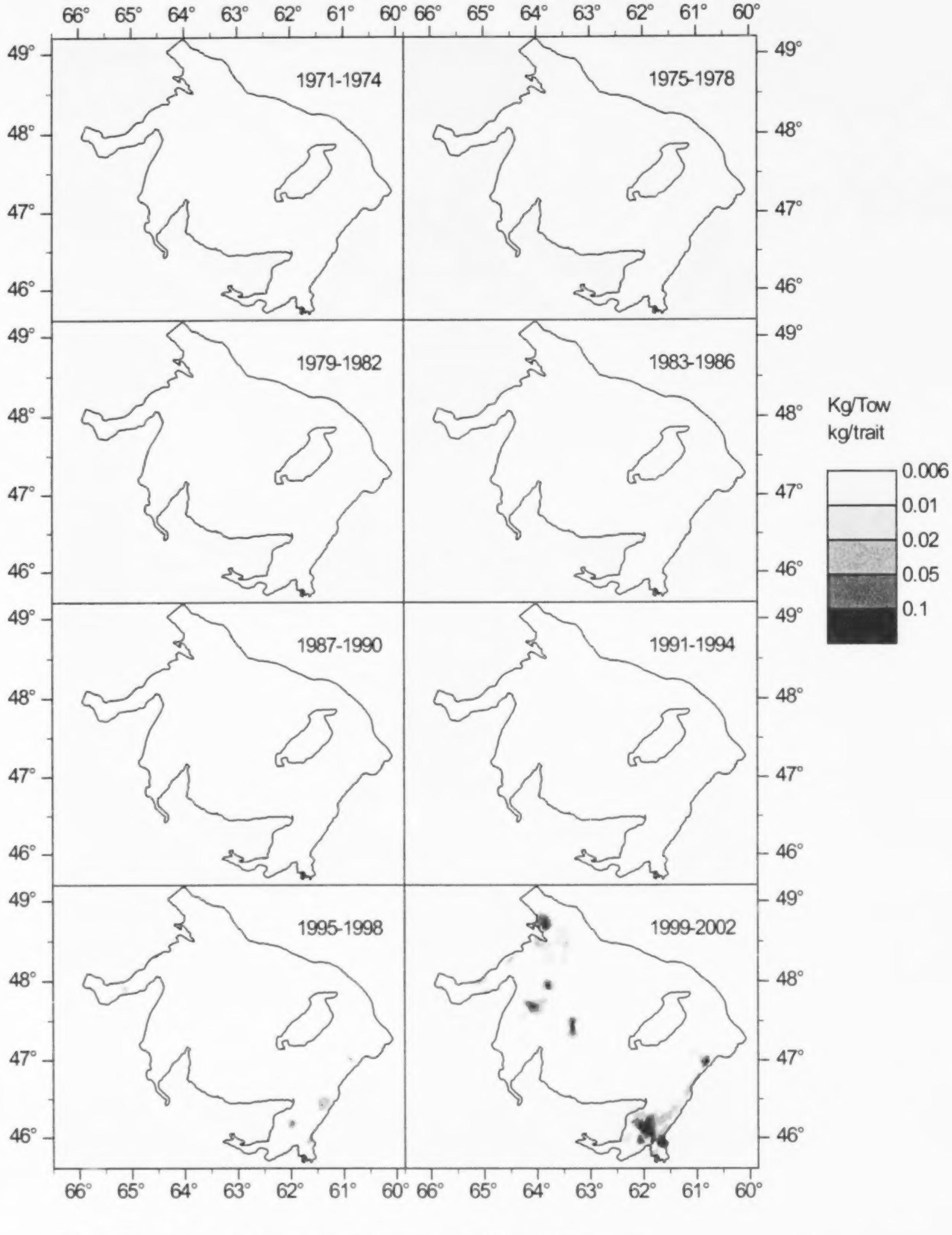

Figure 26a. September distribution of catches (kg) of Slender Eelblenny, *Lumpenus fabricii*

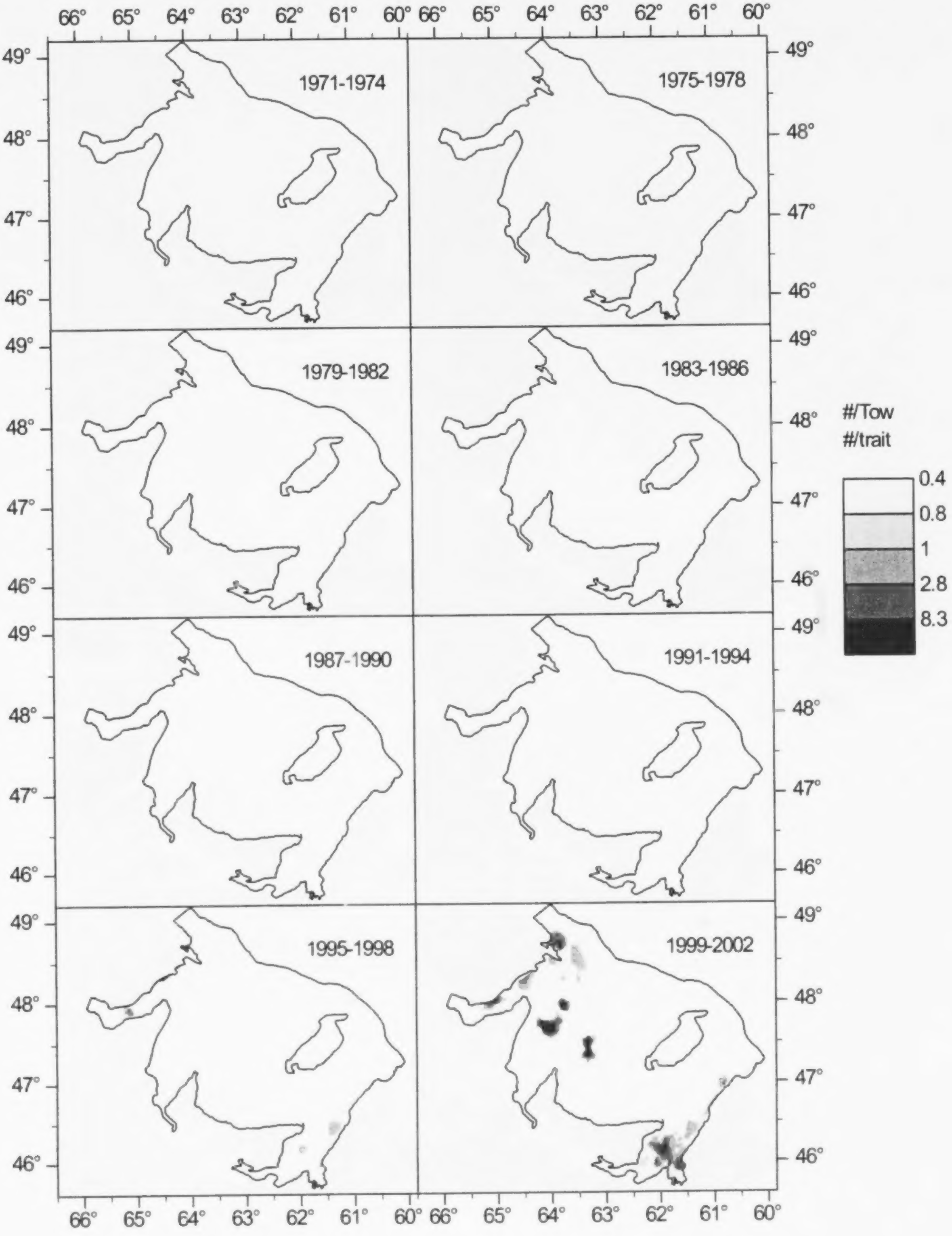

Figure 26b. September distribution of catches (#) of Slender Eelblenny, *Lumpenus fabricii*

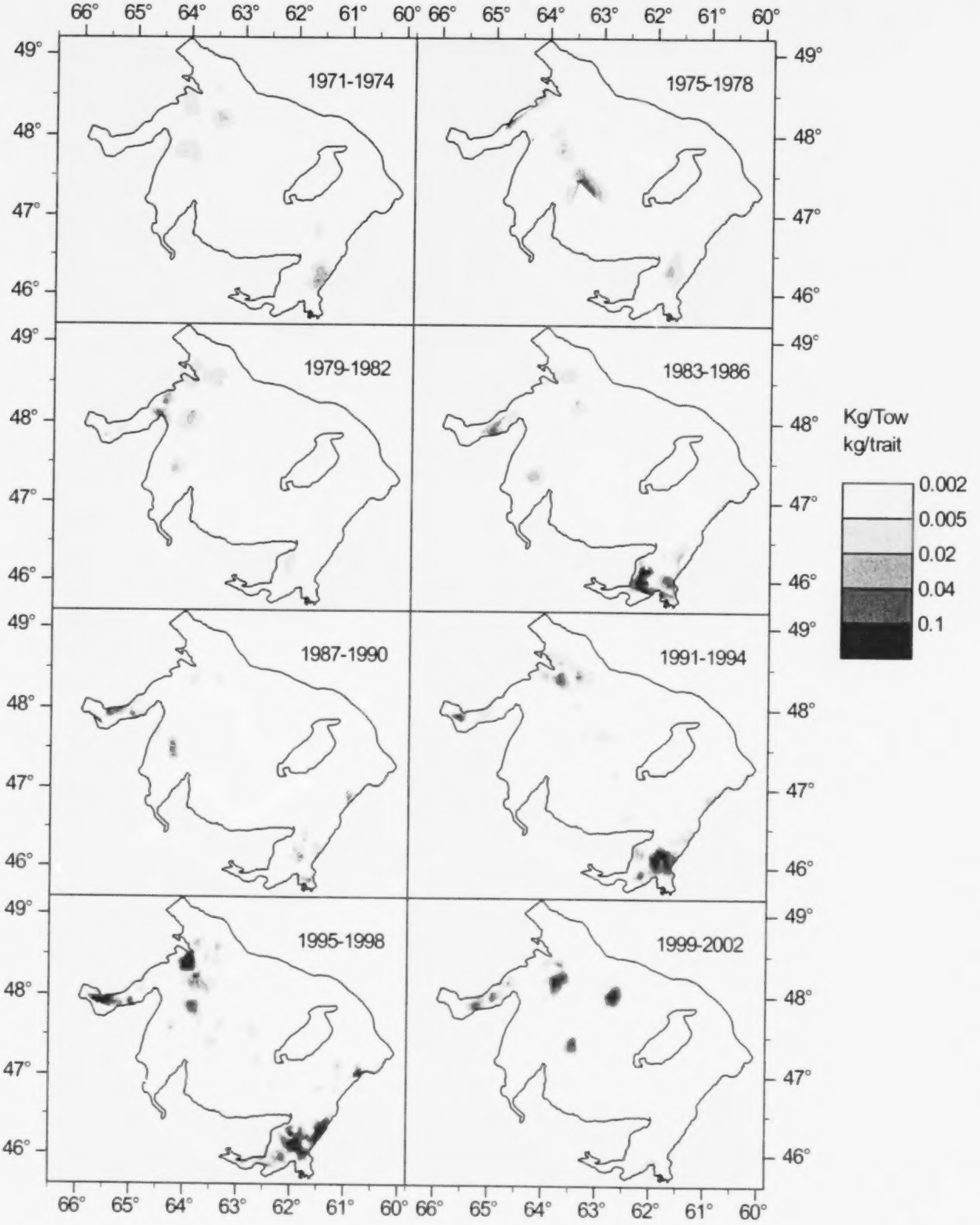

Figure 27a. September distribution of catches (kg) of Snakeblenny, *Lumpenus lampretaeformis*

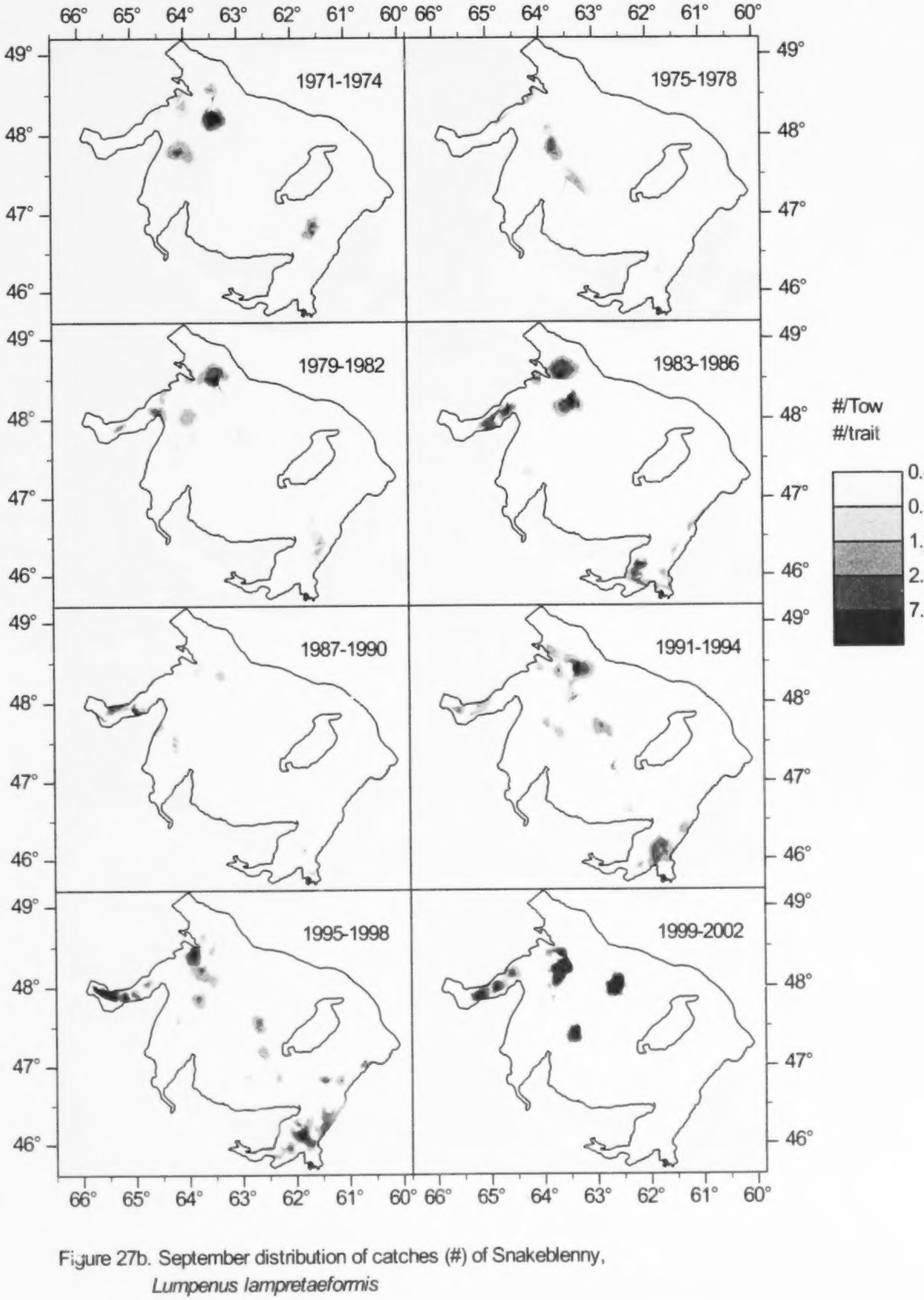

Figure 27b. September distribution of catches (#) of Snakeblenny, *Lumpenus lampretaeformis*

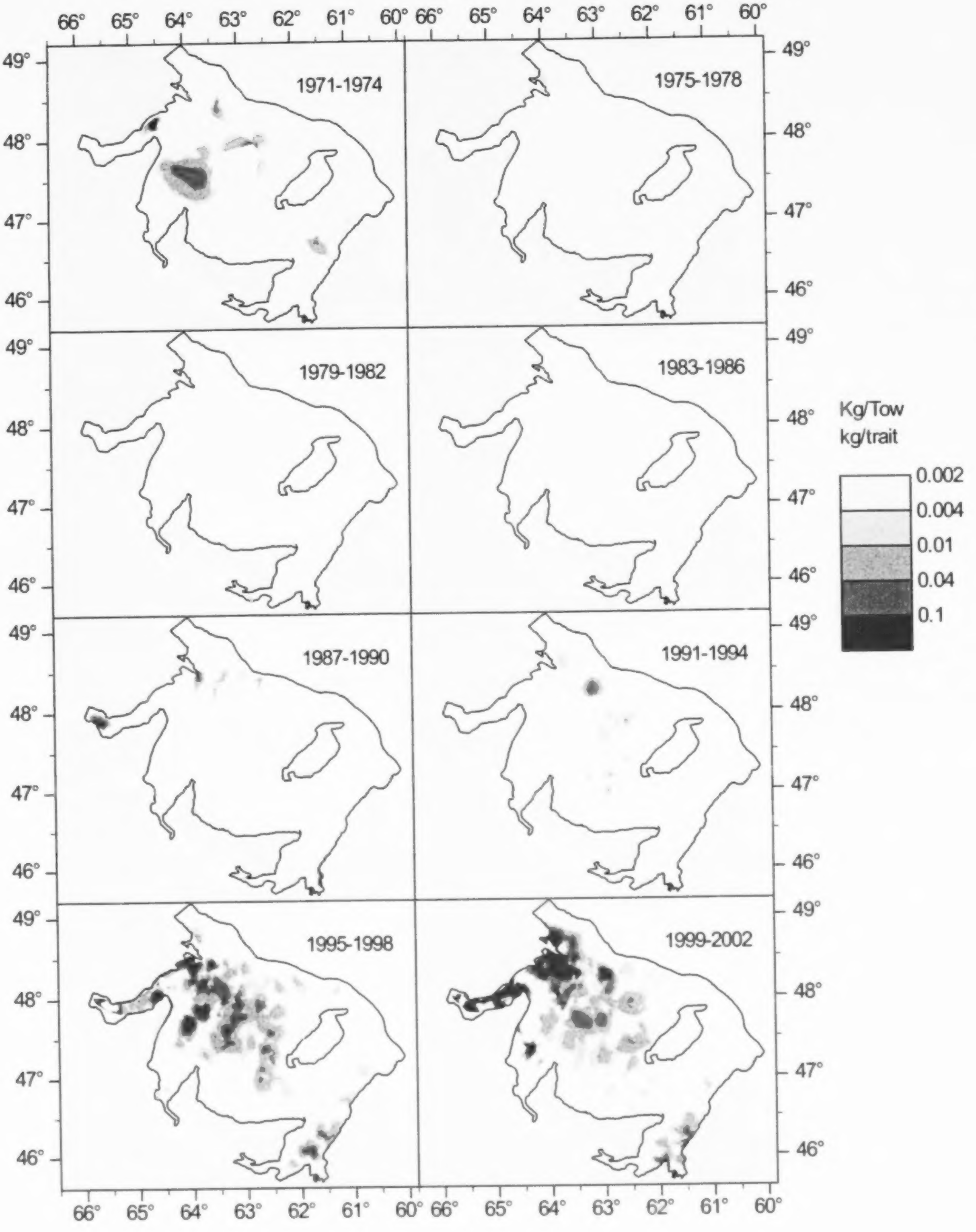

Figure 28a. September distribution of catches (kg) of Daubed Shanny, *Leptoclinus maculatus*

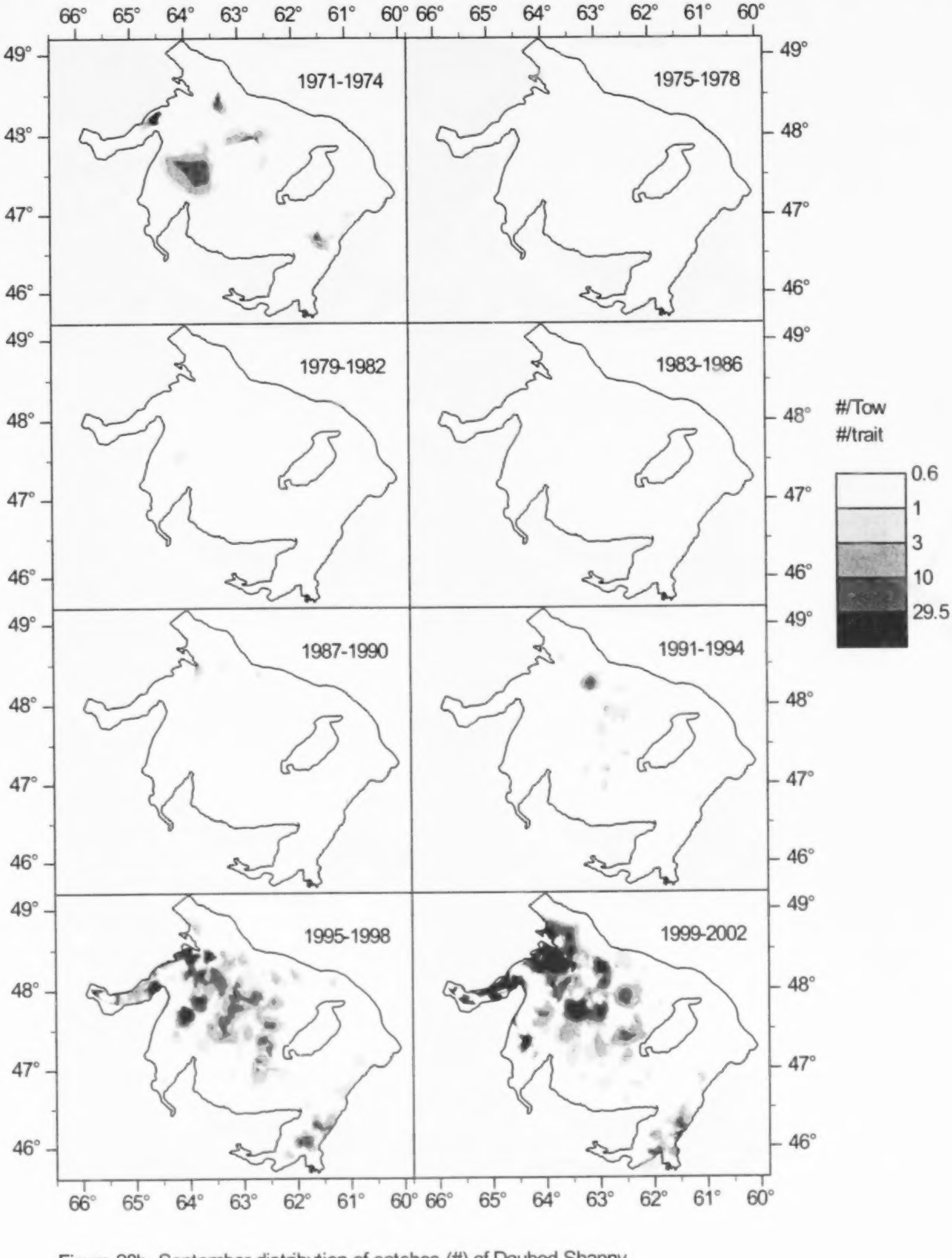

Figure 28b. September distribution of catches (#) of Daubed Shanny, *Leptoclinus maculatus*

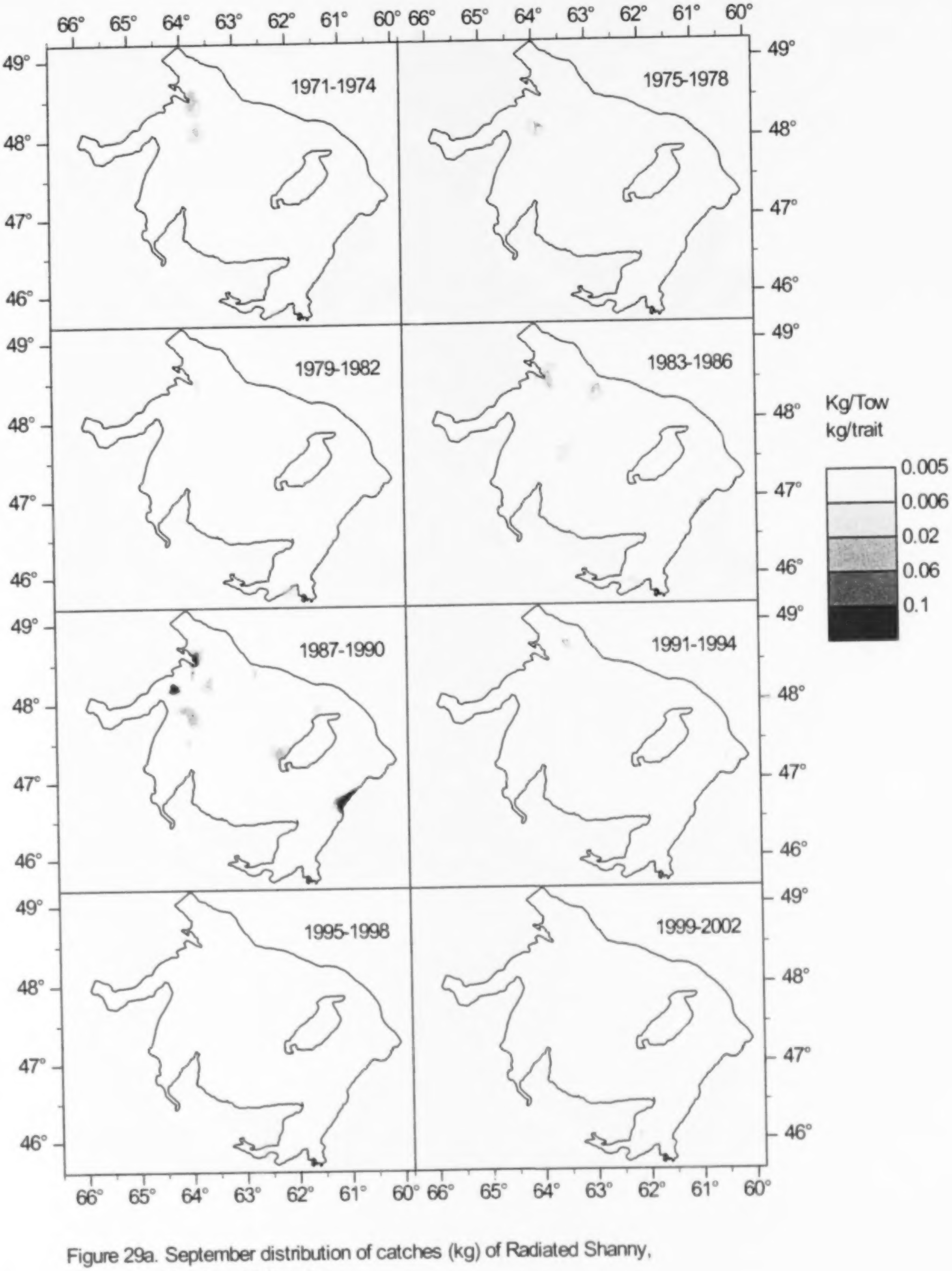

Figure 29a. September distribution of catches (kg) of Radiated Shanny, *Ulvaria subbifurcata*

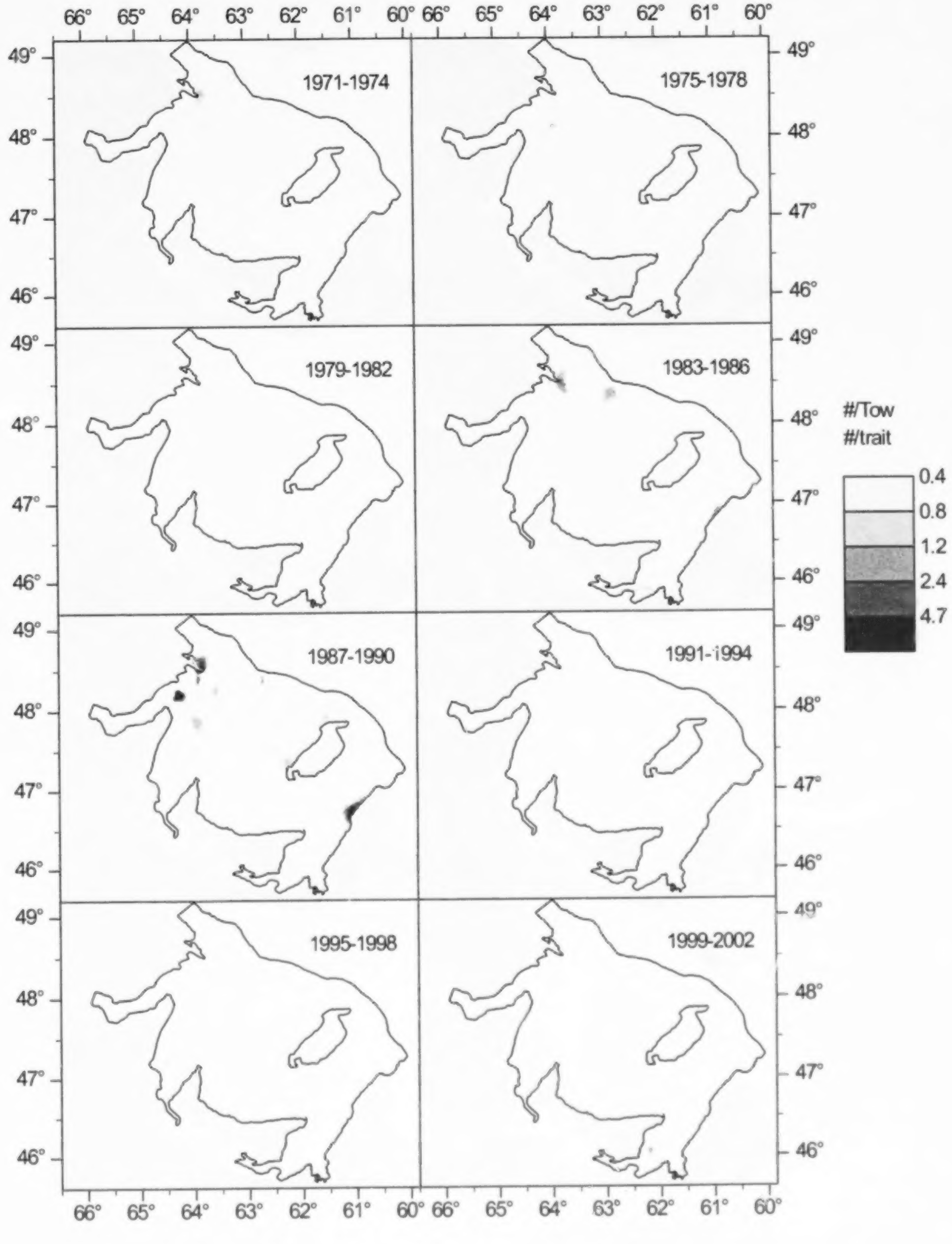

Figure 29b. September distribution of catches (#) of Radiated Shanny,
Ulvaria subbifurcata

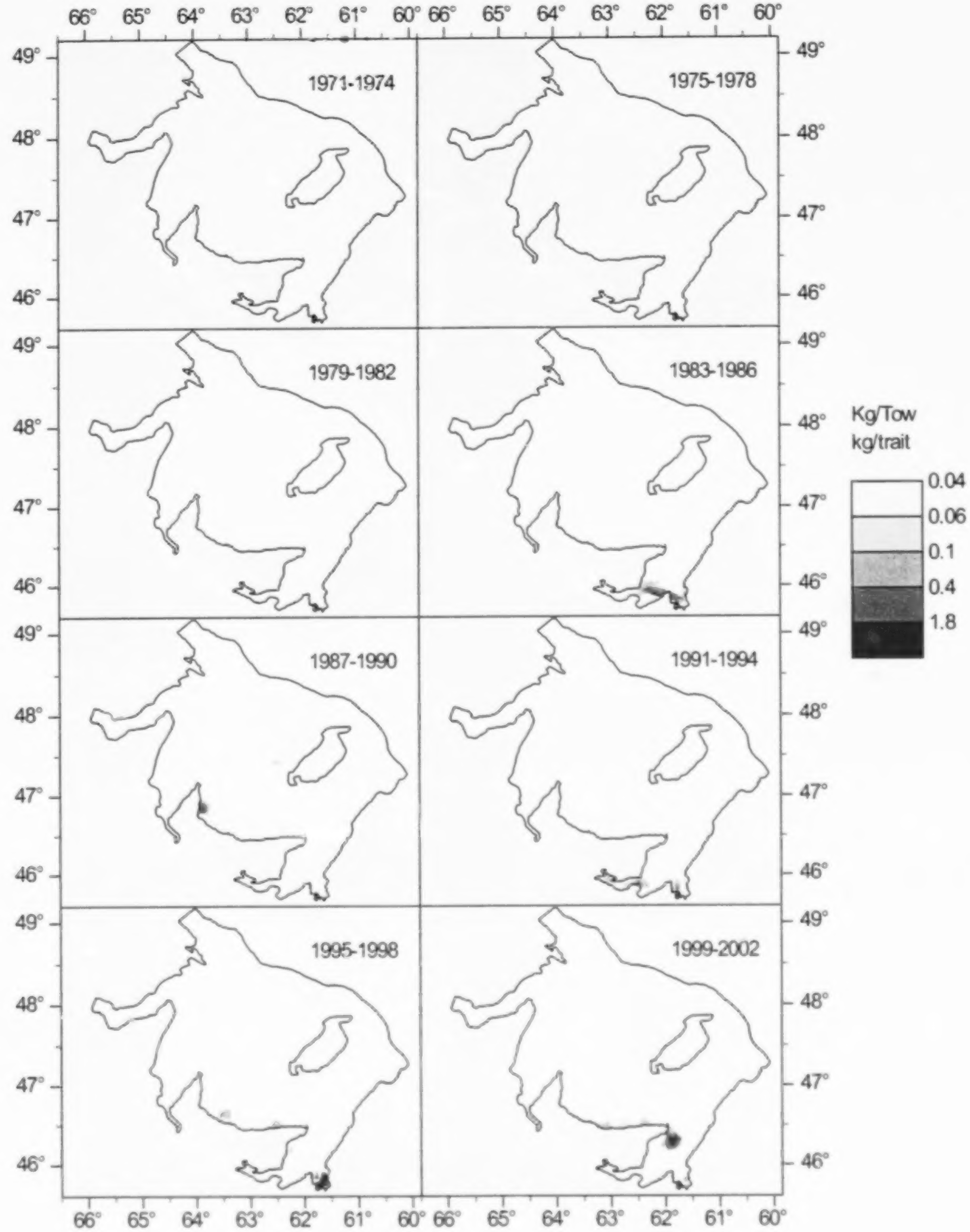

Figure 30a. September distribution of catches (kg) of Butterfish, *Peprilus tricanthus*

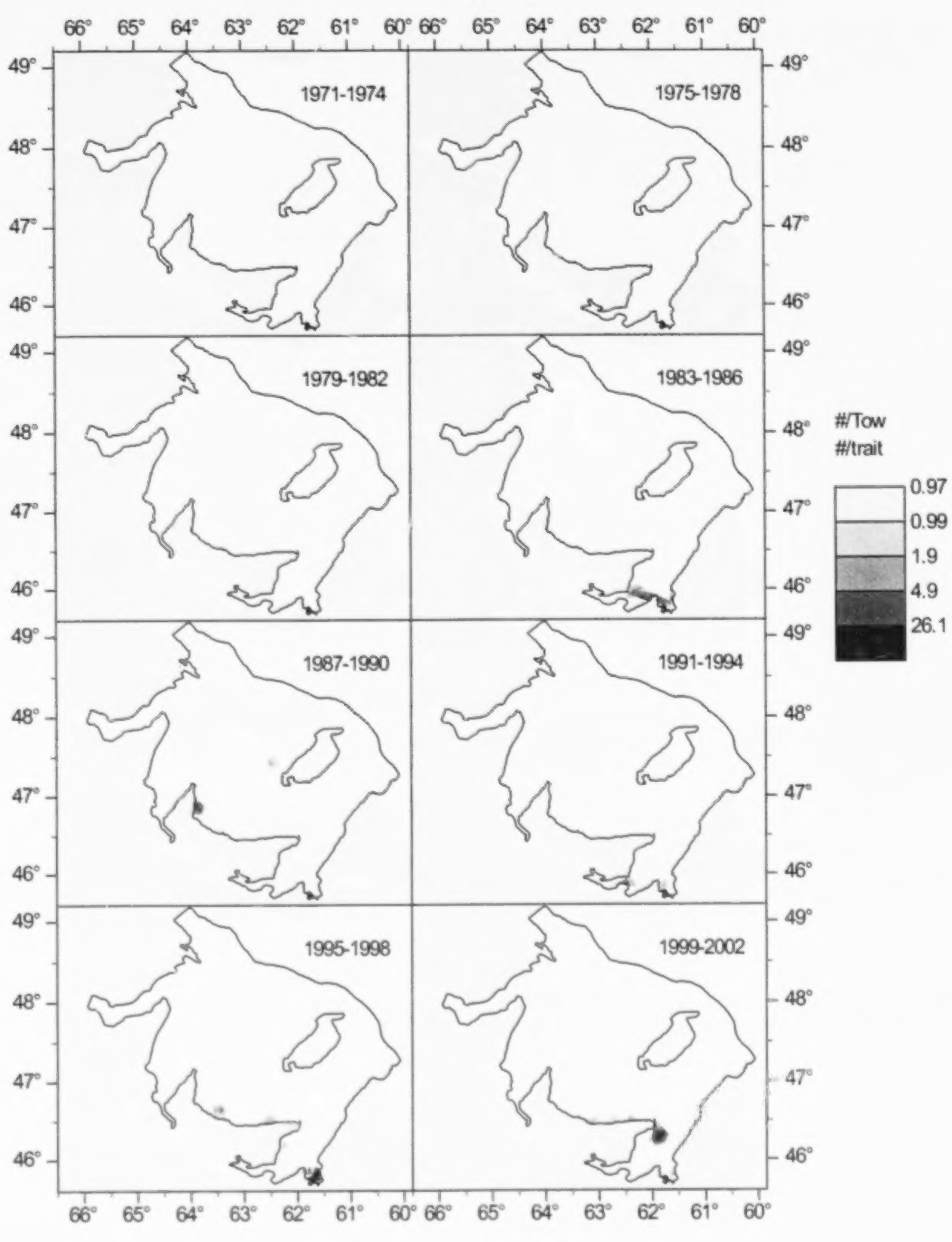

Figure 30b. September distribution of catches (#) of Butterfish, *Peprilus tricanthus*

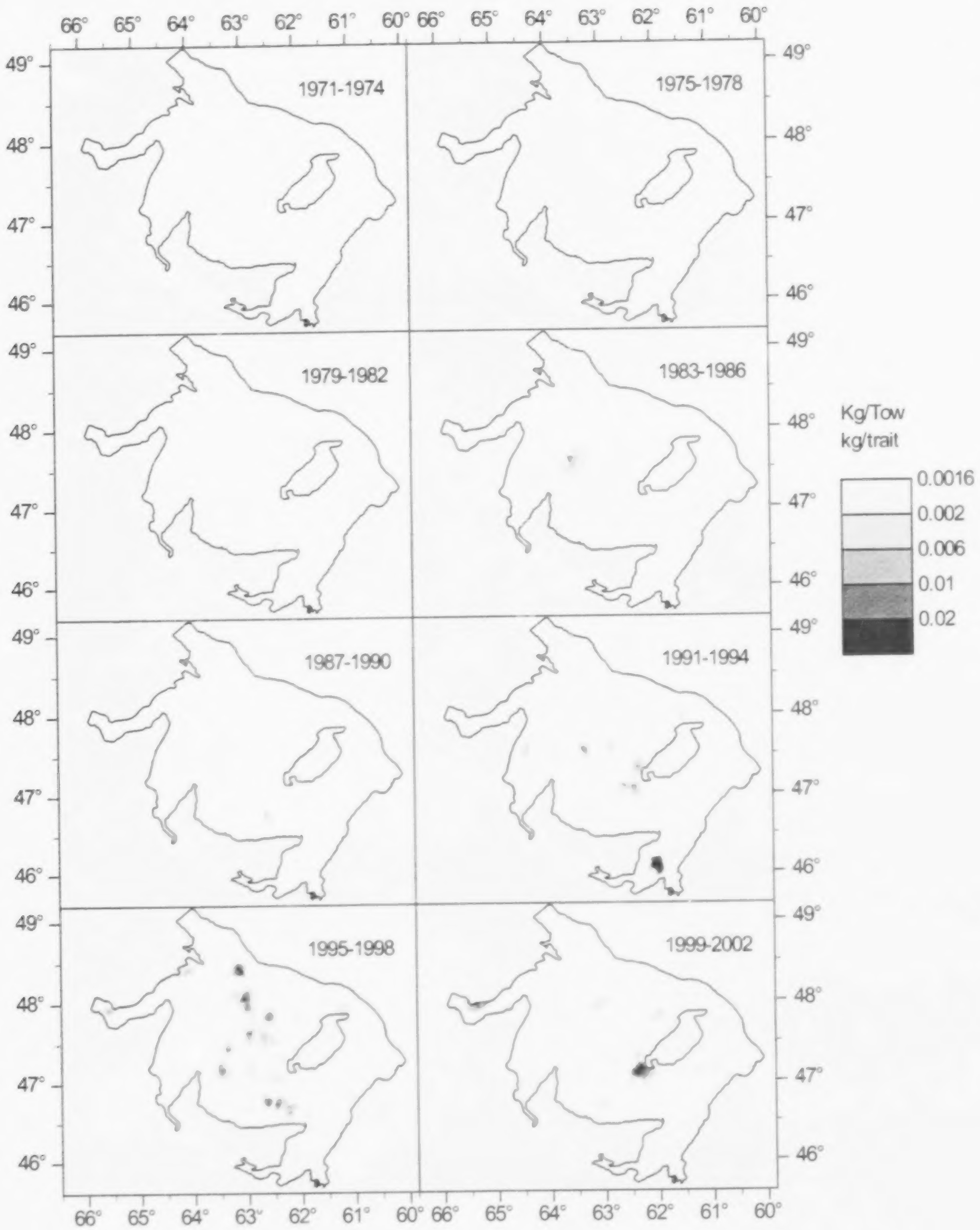

Figure 31a September distribution of catches (kg) of Fish Doctor, *Gymnelus viridis*

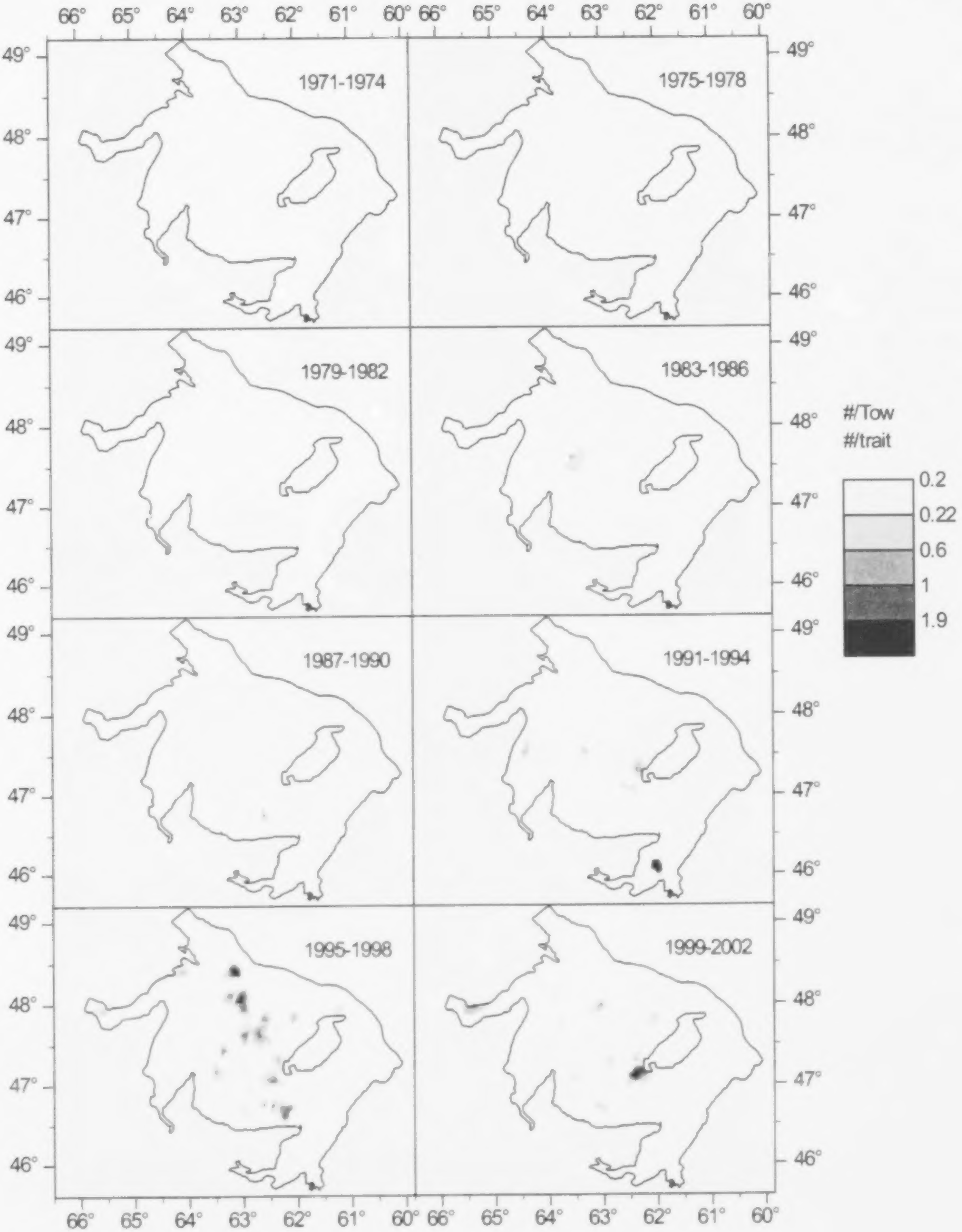

Figure 31b. September distribution of catches (#) of Fish Doctor, *Gymnelus viridis*

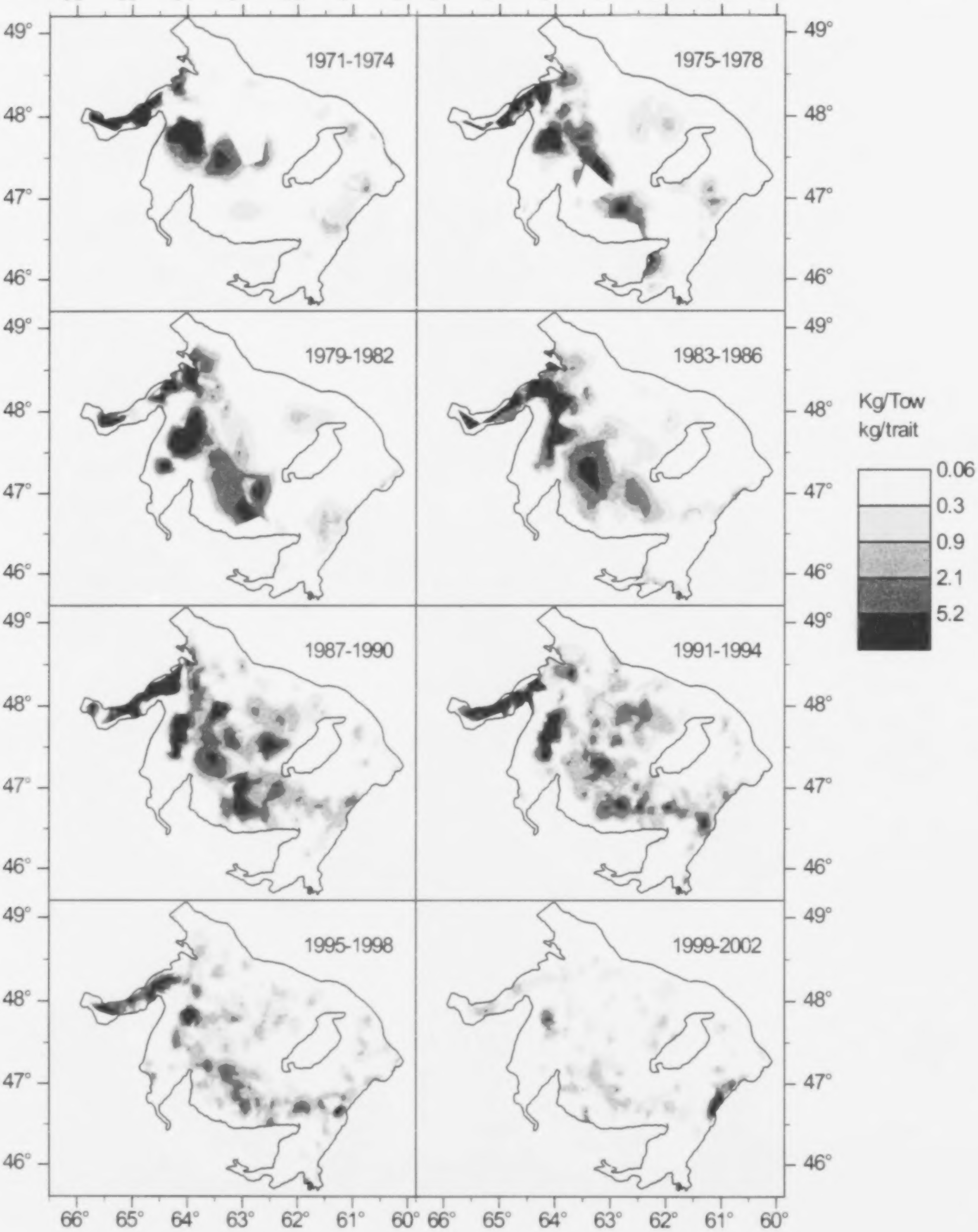

Figure 32a. September distribution of catches (kg) of Eelpout, *Lycodes sp.*

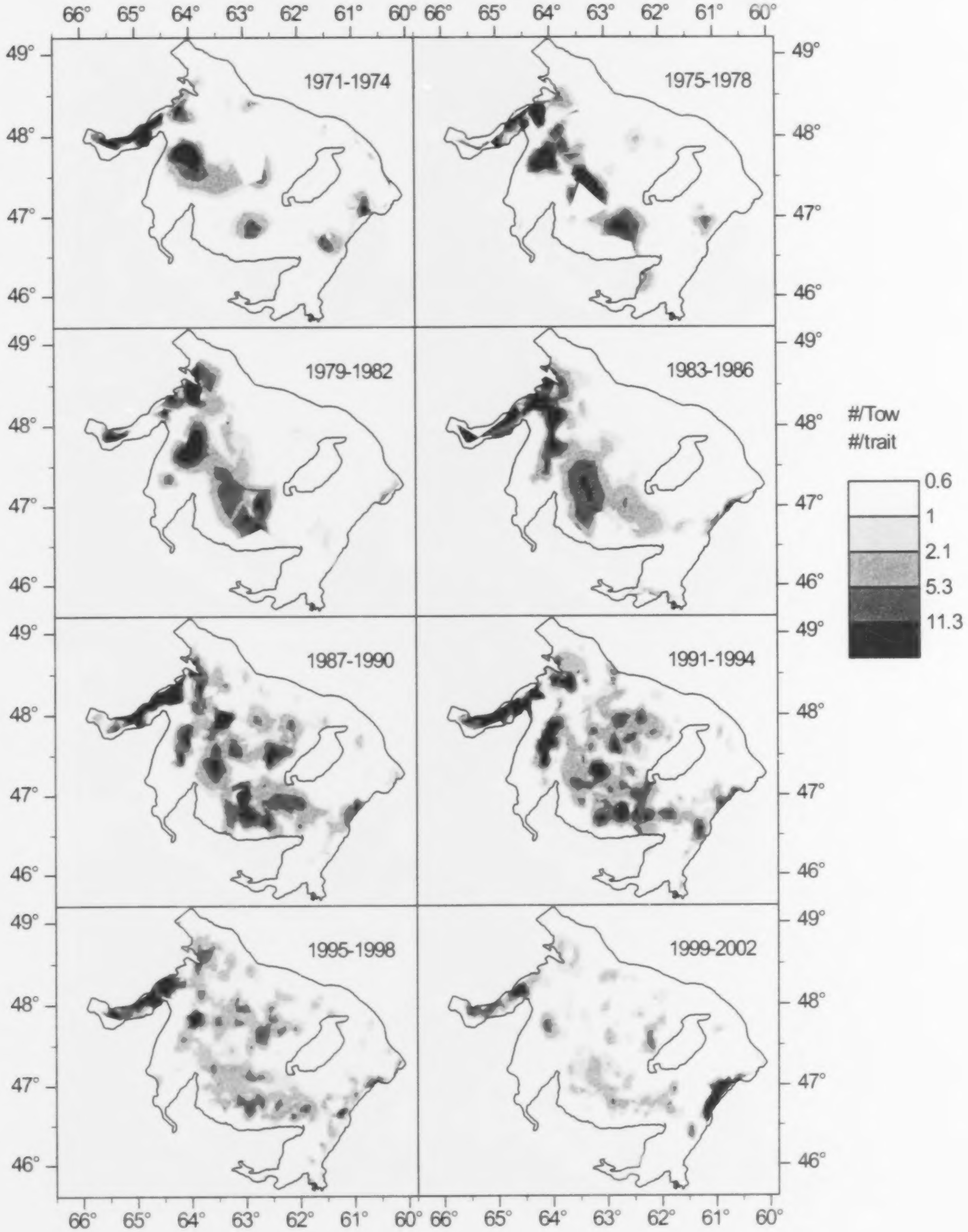

Figure 32b. September distribution of catches (#) of Eelpout, *Lycodes sp.*

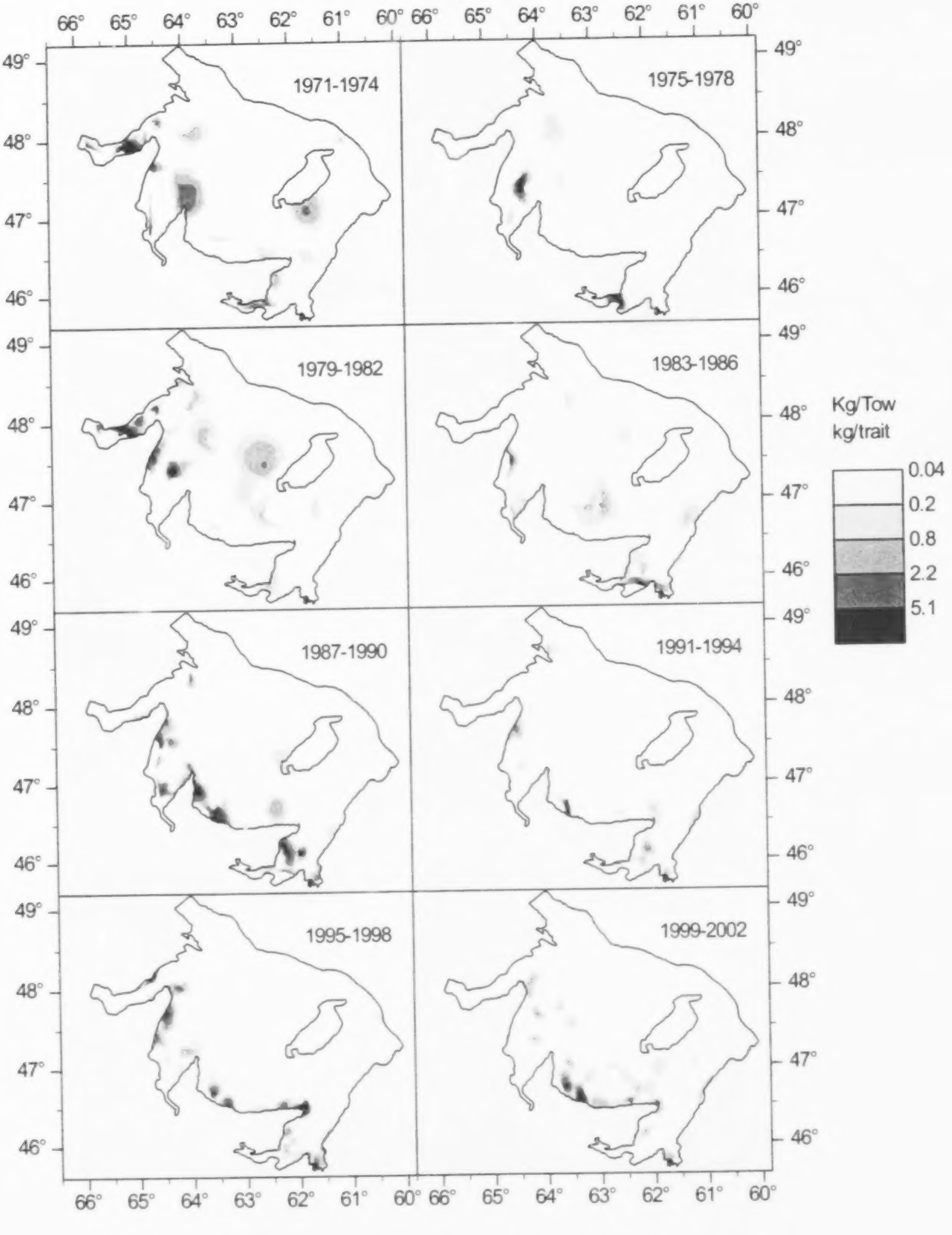

Figure 33a. September distribution of catches (kg) of Common Ocean Pout, *Zoarces americanus*

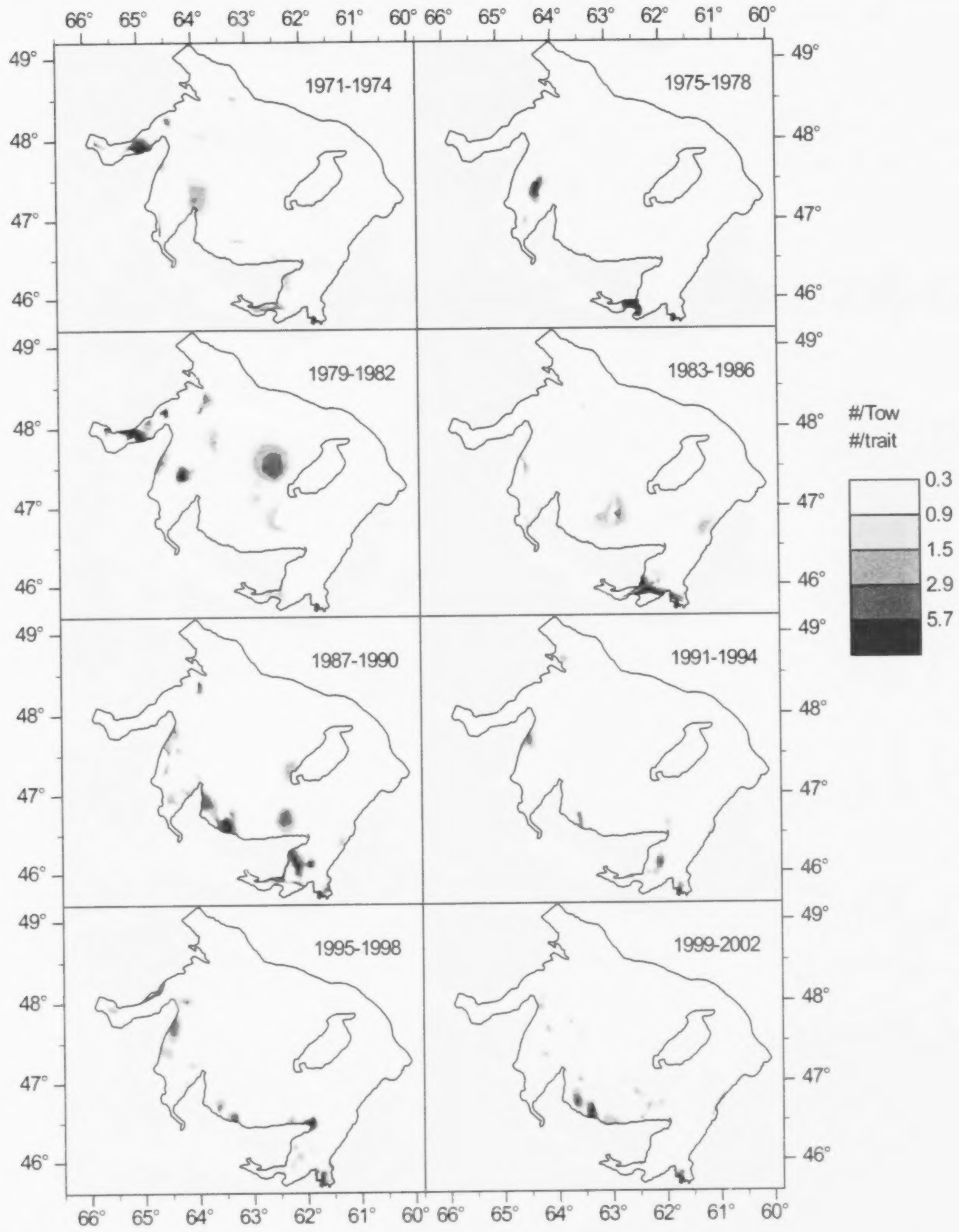

Figure 33b. September distribution of catches (#) of Common Ocean Pout, *Zoarces americanus*

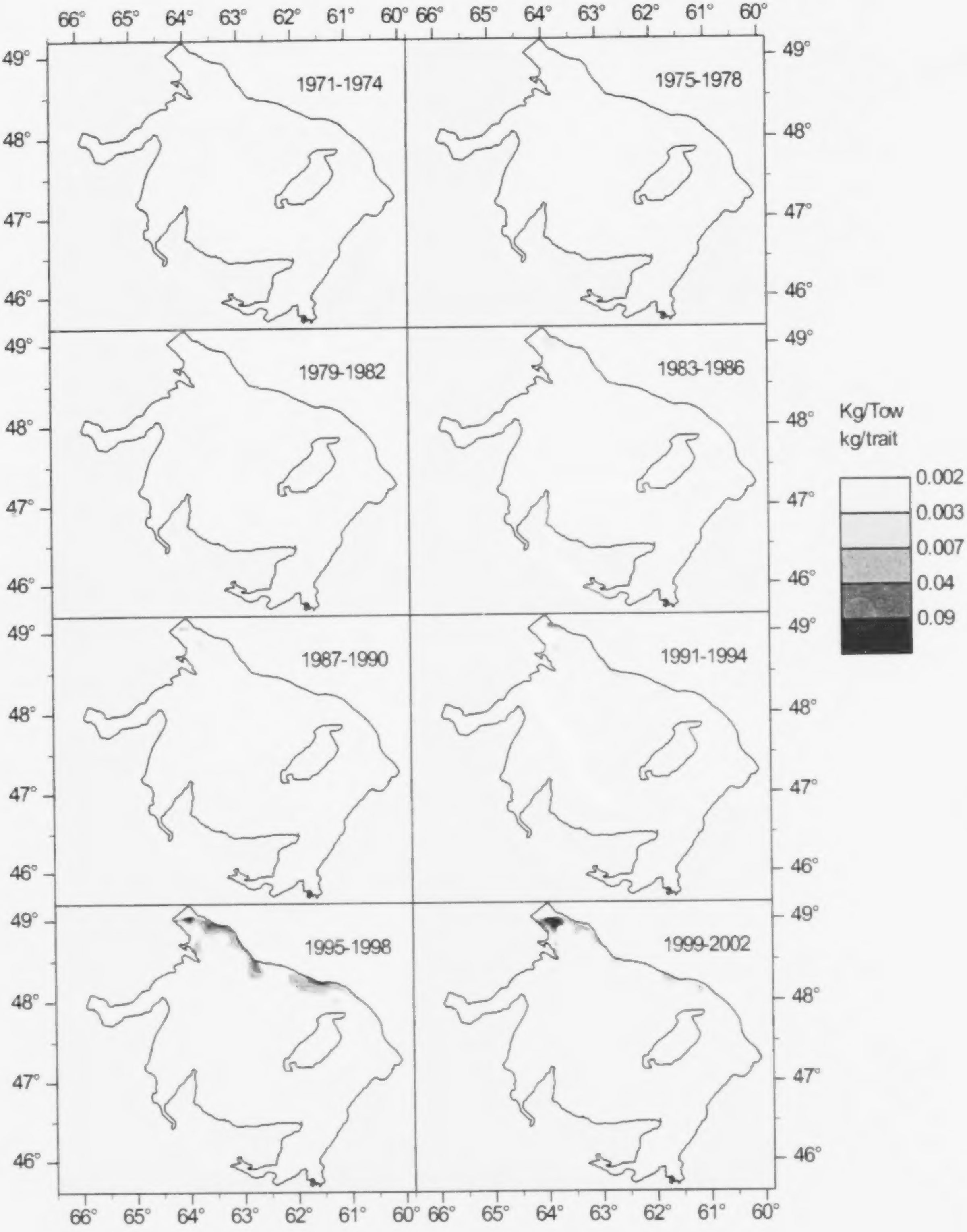

Figure 34a. September distribution of catches (kg) of Atlantic Softpout, *Melanostigma atlanticum*

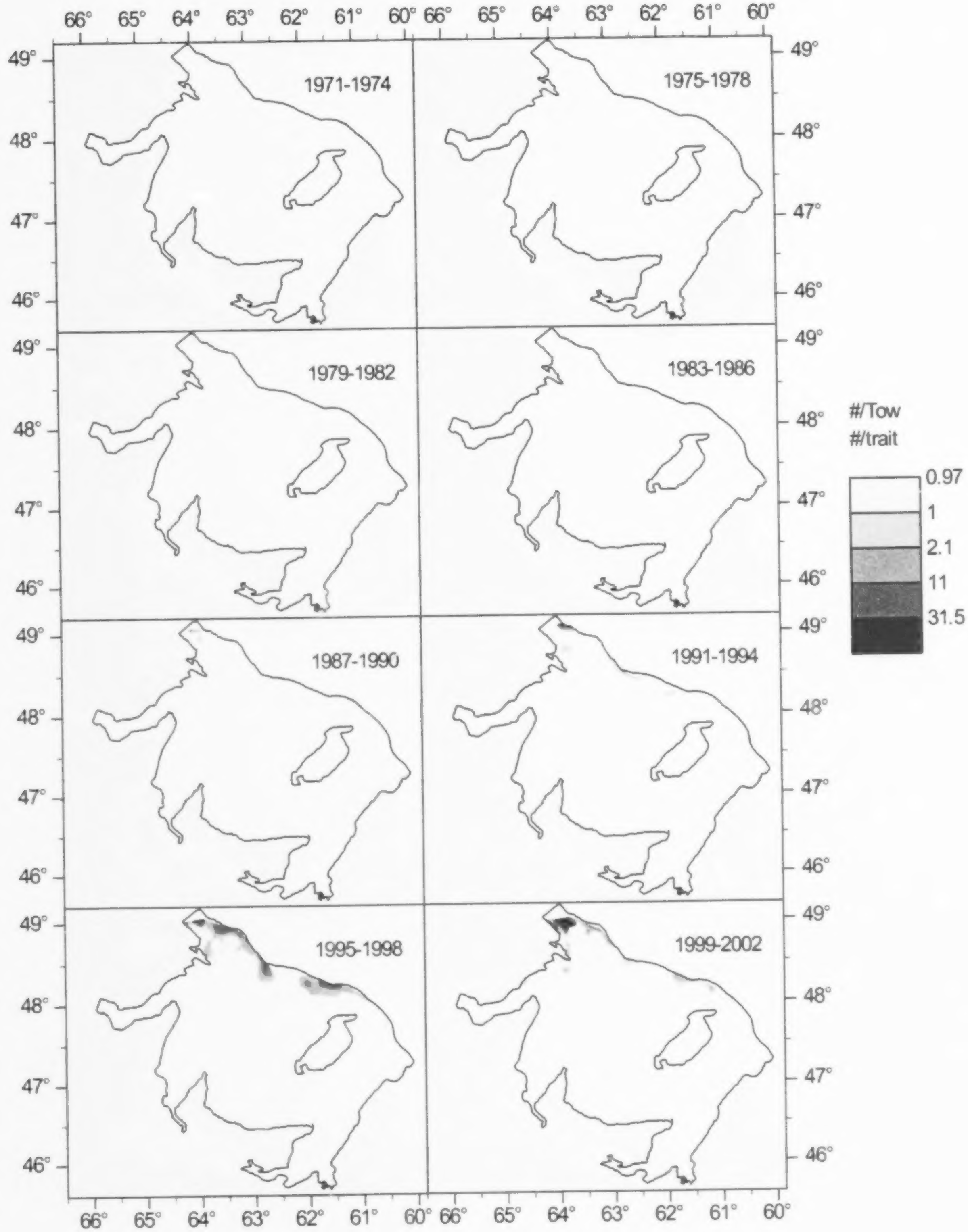

Figure 34b. September distribution of catches (#) of Atlantic Softpout, *Melanostigma atlanticum*

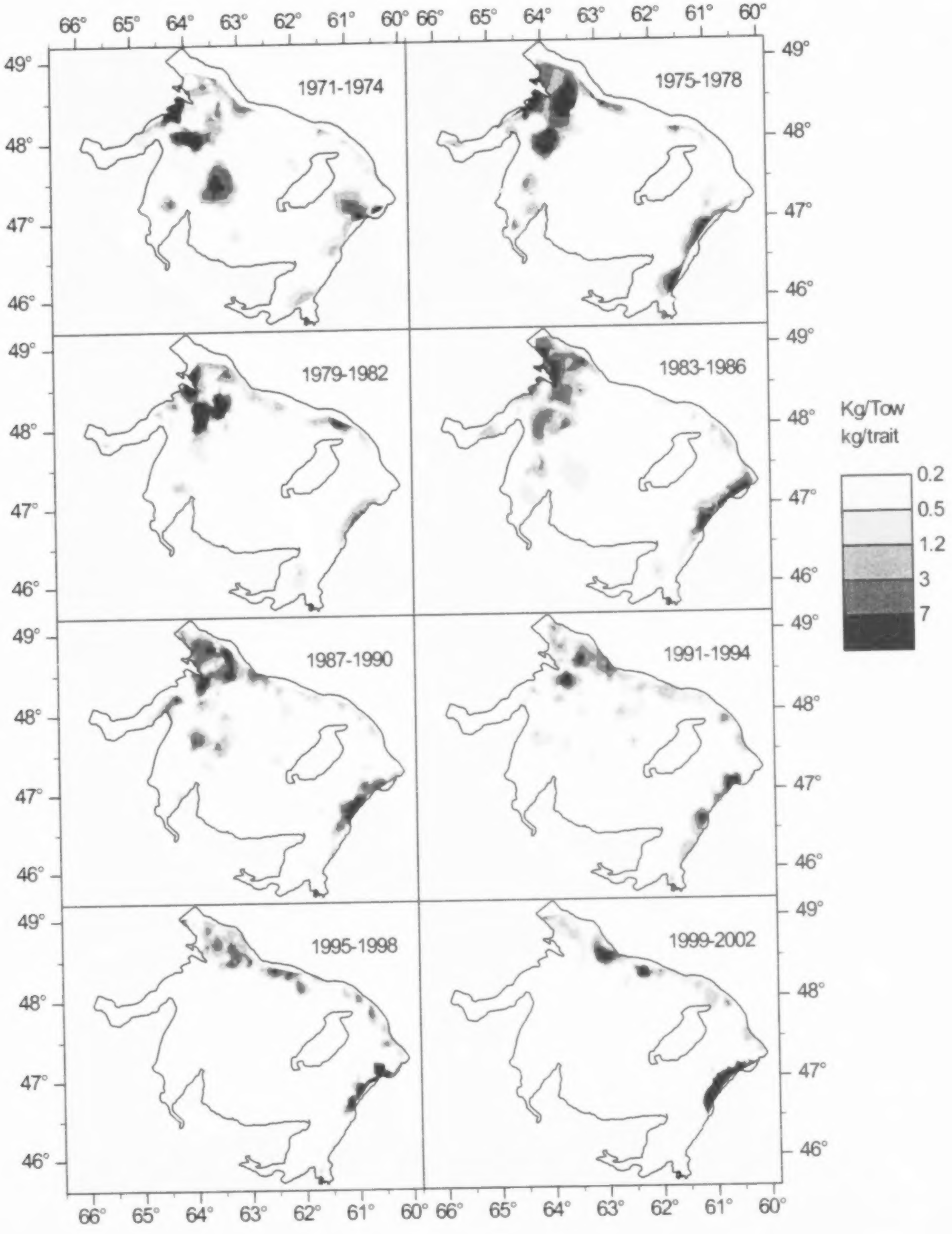

Figure 35a. September distribution of catches (kg) of Witch Flounder, *Glyptocephalus cynoglossus*

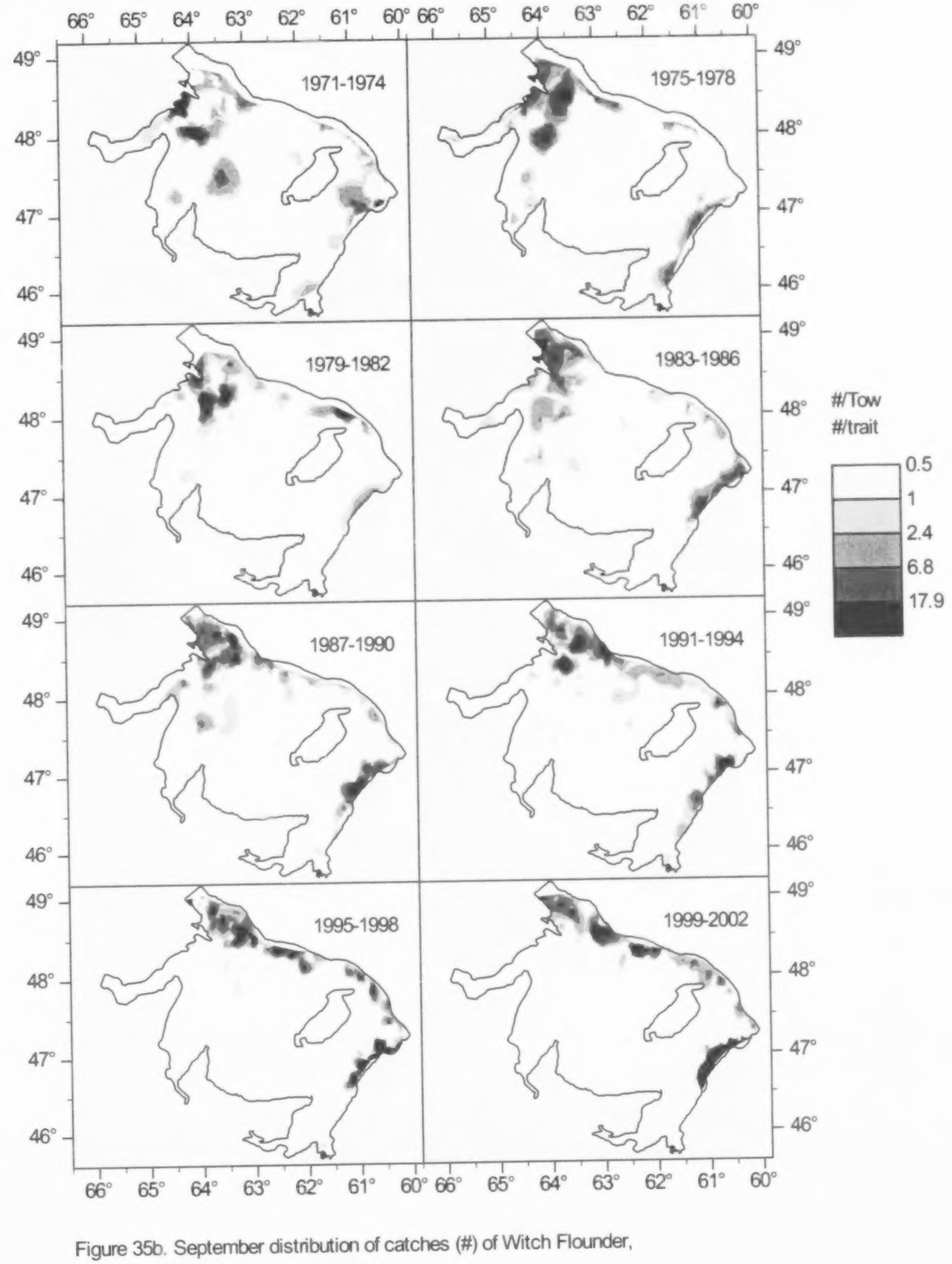

Figure 35b. September distribution of catches (#) of Witch Flounder, *Glyptocephalus cynoglossus*

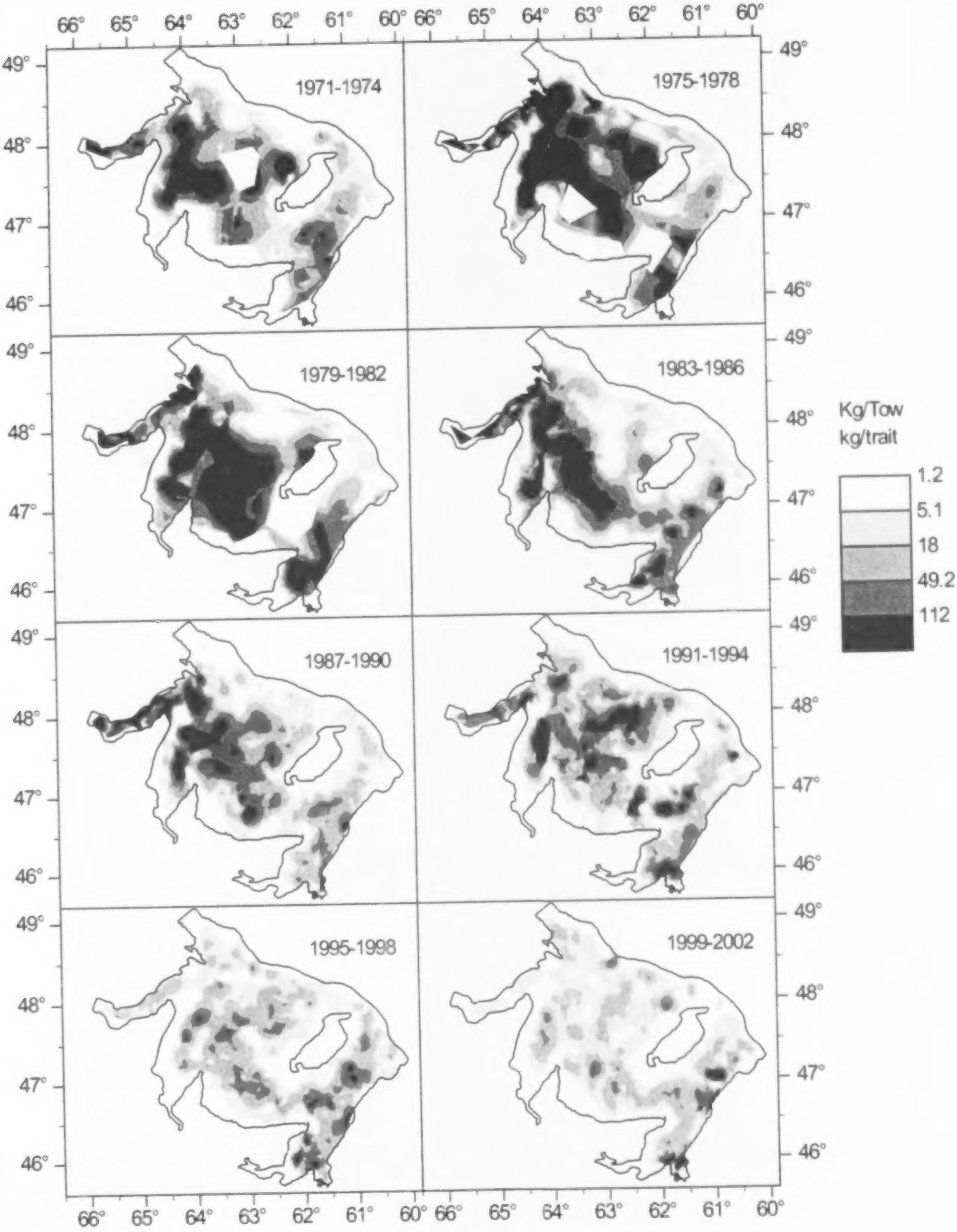

Figure 36a. September distribution of catches (kg) of American Plaice, *Hippoglossoides platessoides*

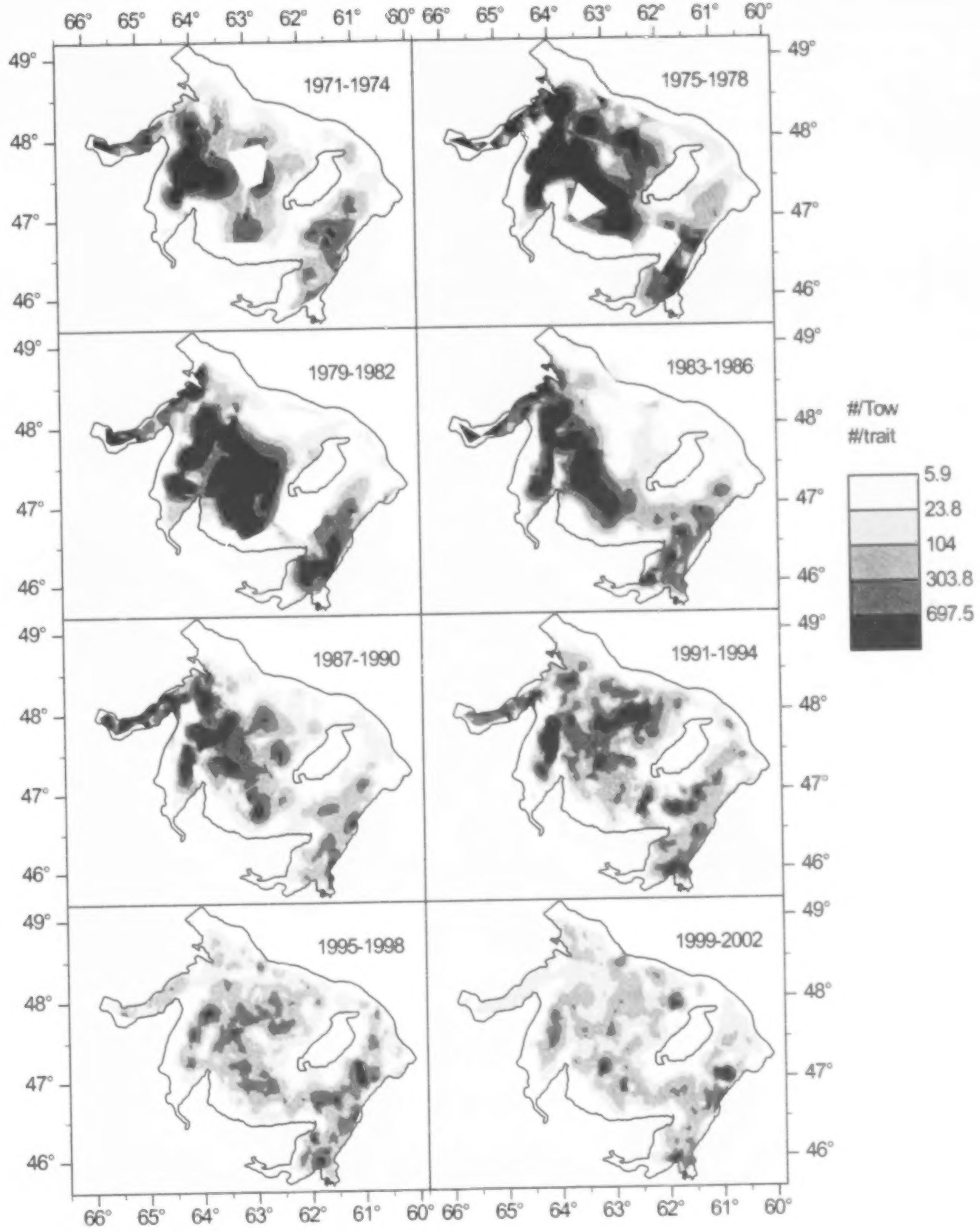

Figure 36b. September distribution of catches (#) of American Plaice, *Hippoglossoides platessoides*

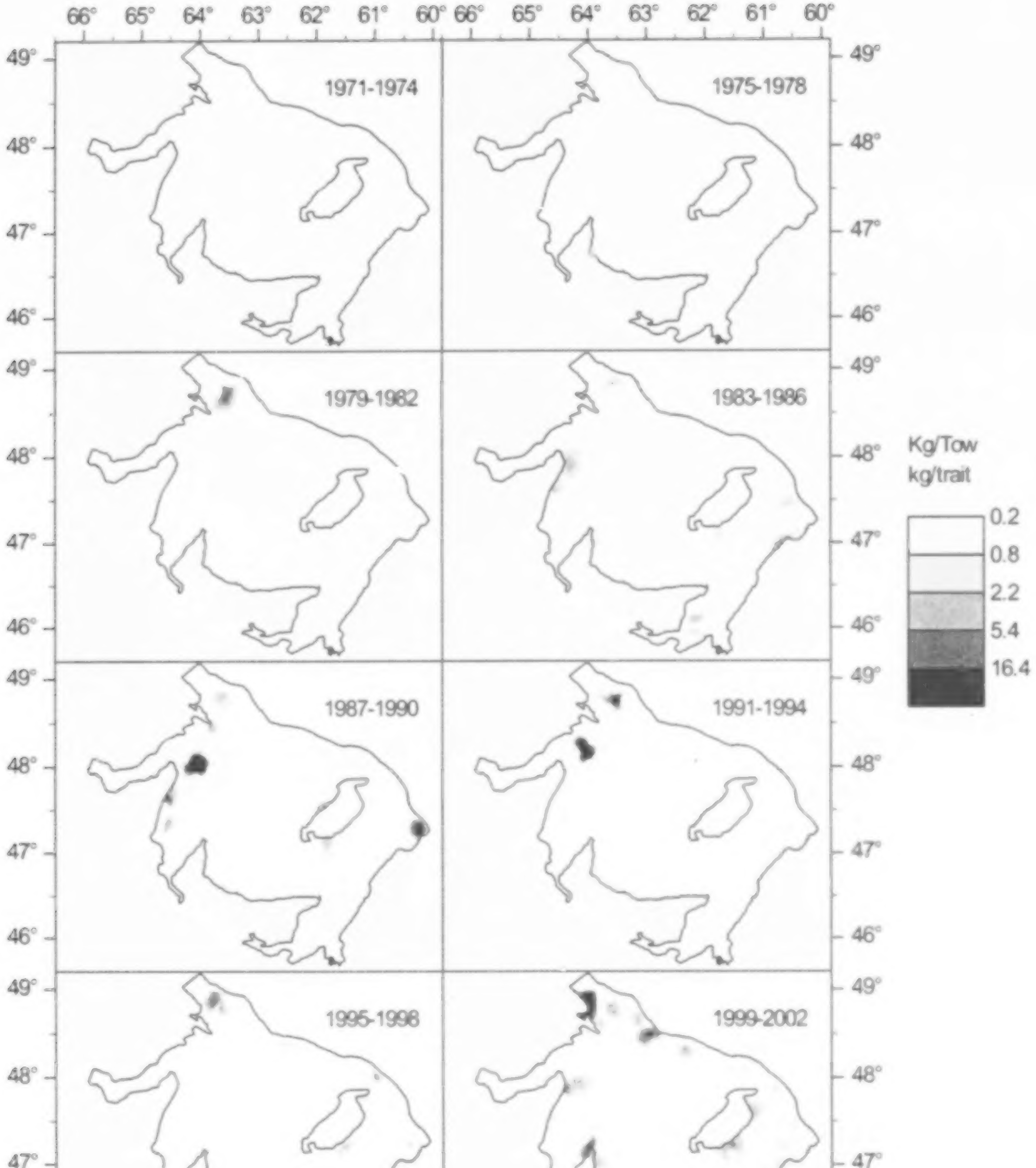

Figure 37a. September distribution of catches (kg) of Atlantic Halibut, *Hippoglossus hippoglossus*

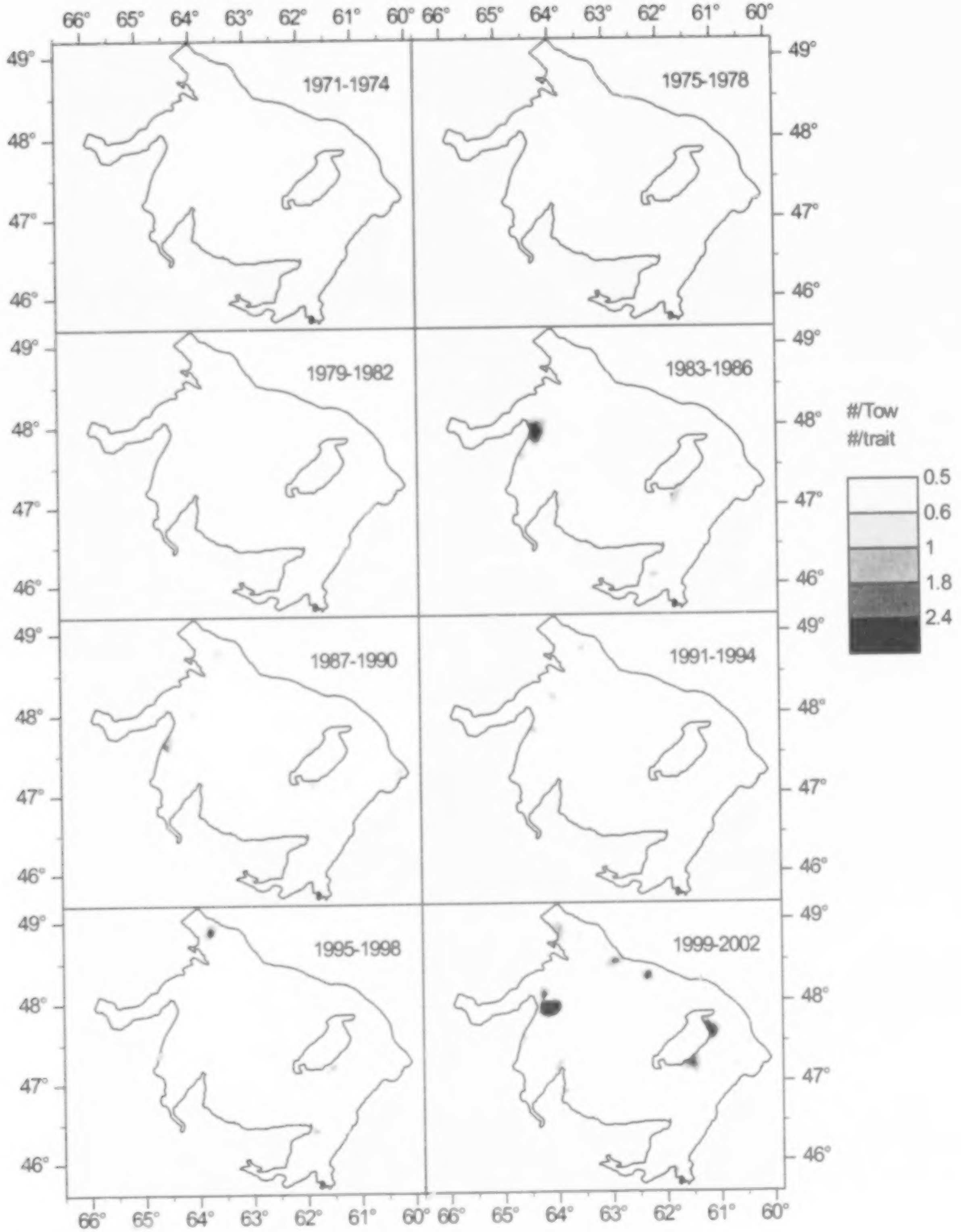

Figure 37b. September distribution of catches (#) of Atlantic Halibut, *Hippoglossus hippoglossus*

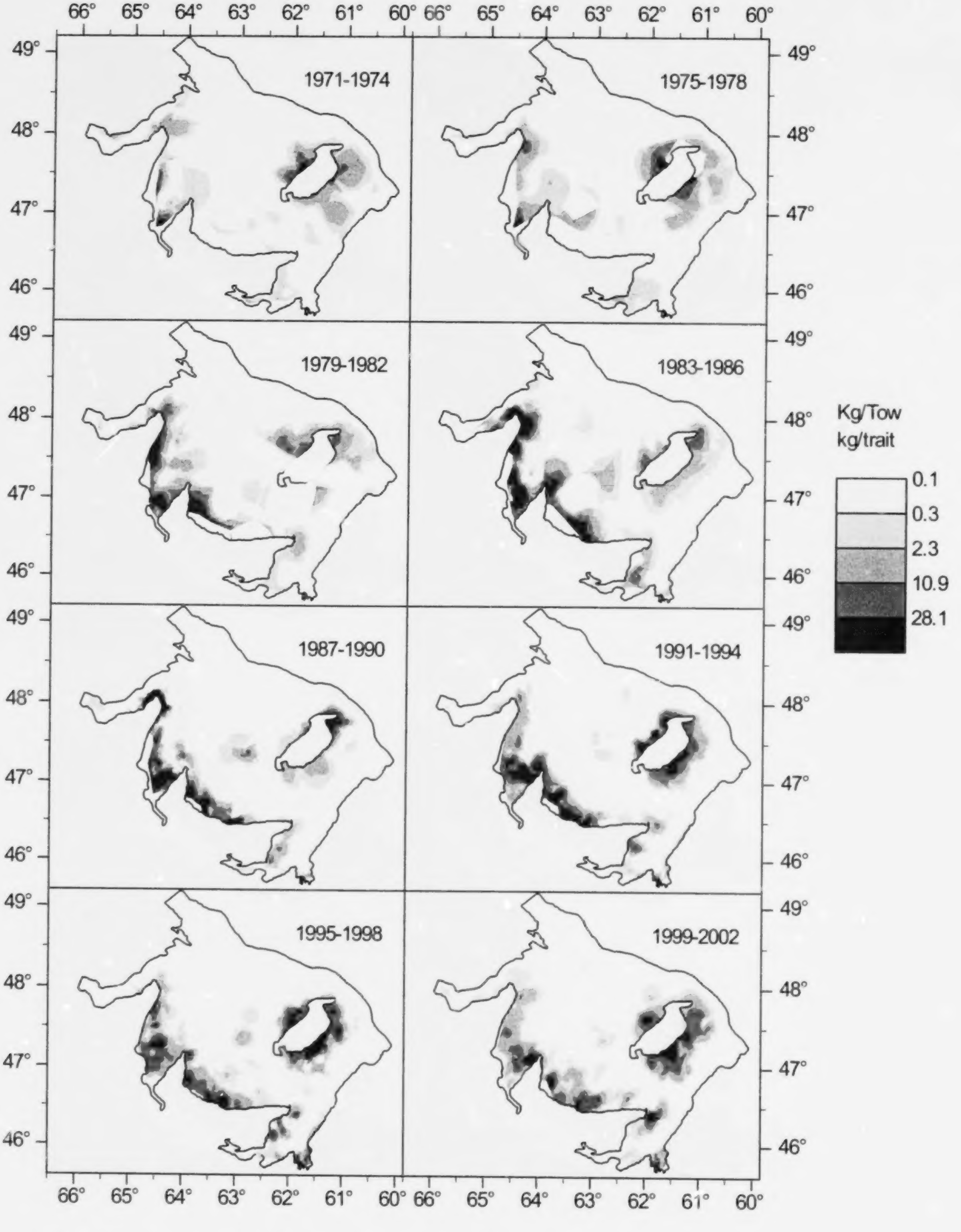

Figure 38a. September distribution of catches (kg) of Yellowtail Flounder, *Limanda ferruginea*

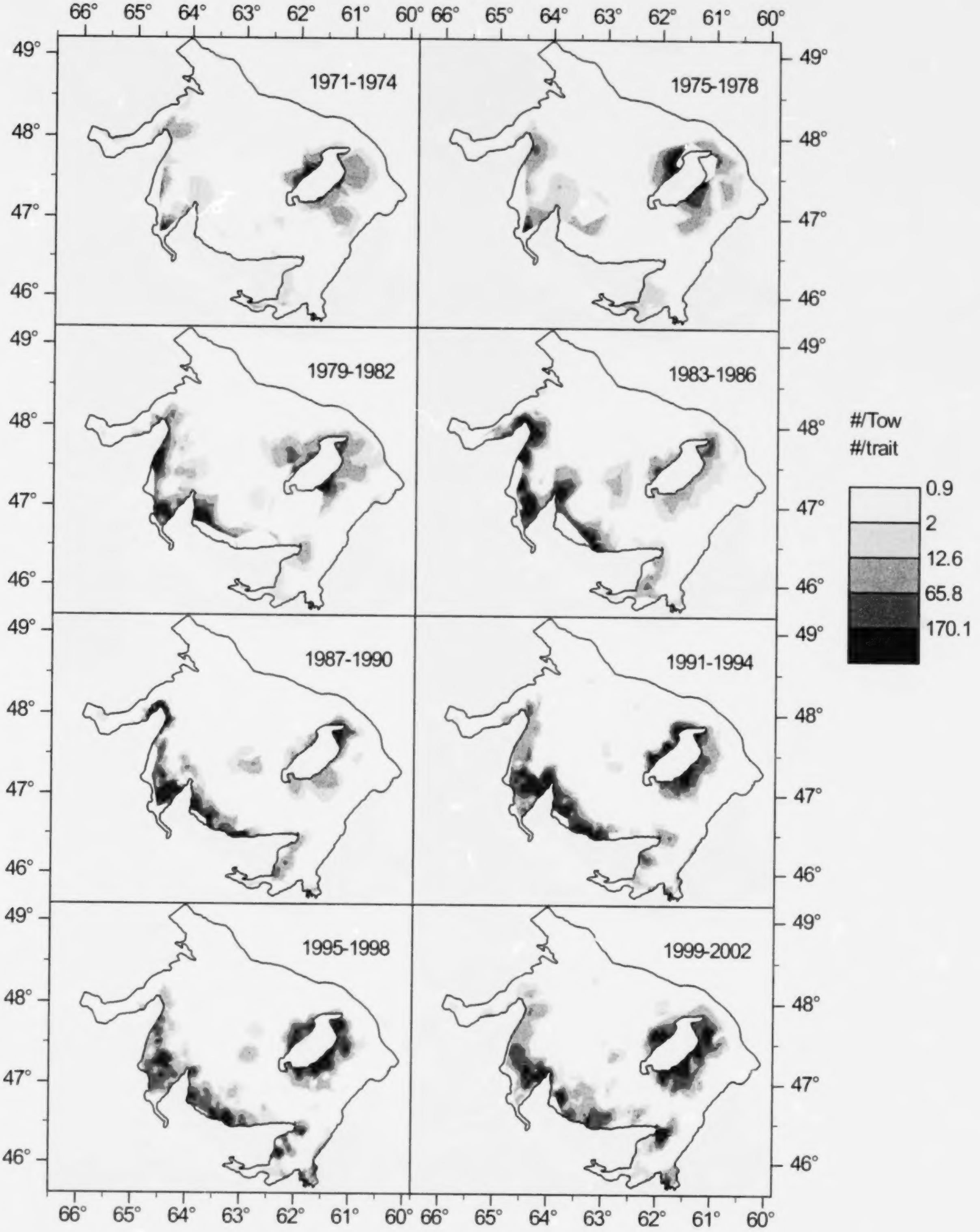

Figure 38b. September distribution of catches (#) of Yellowtail Flounder, *Limanda ferruginea*

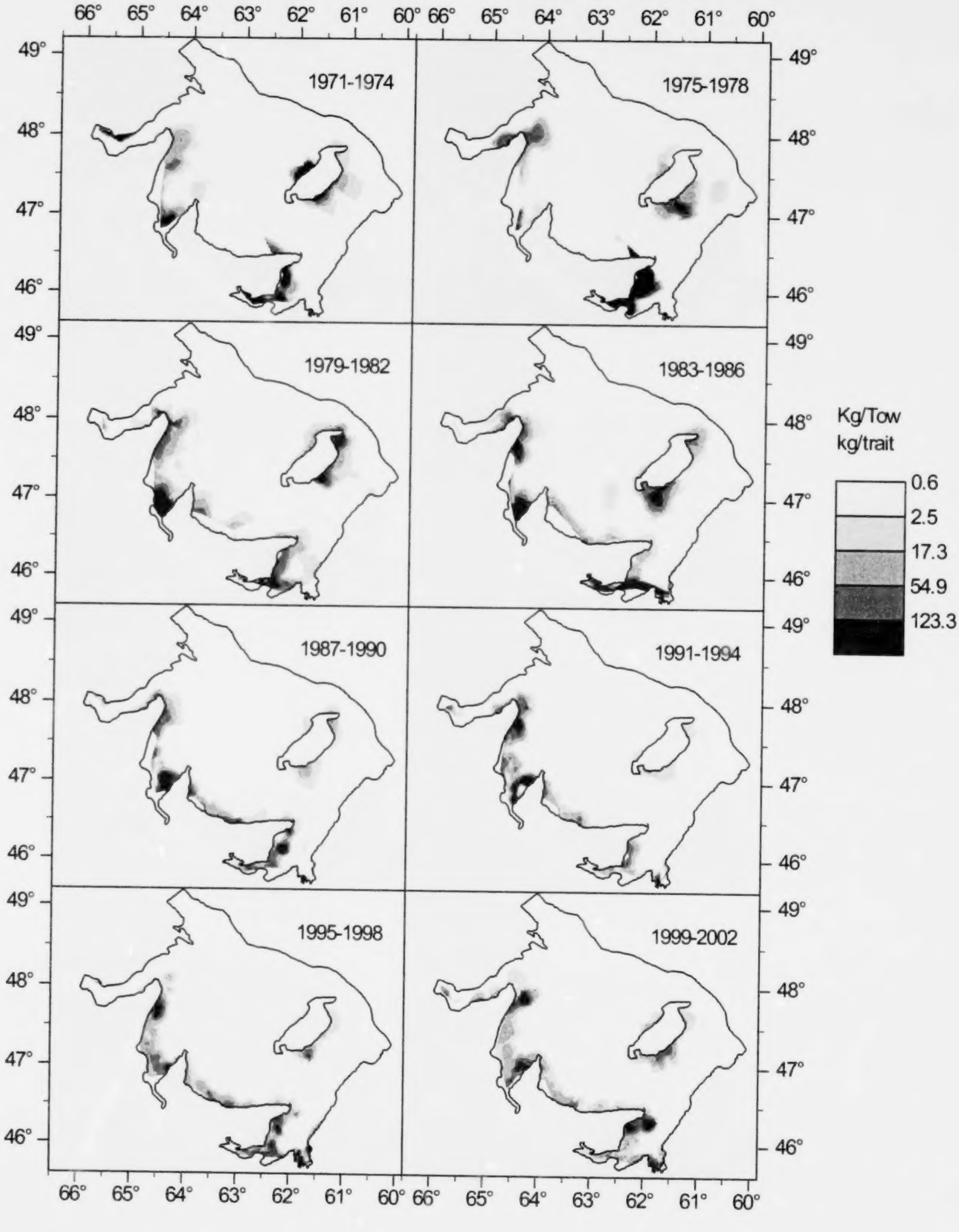

Figure 39a. September distribution of catches (kg) of Winter Flounder, *Pseudopleuronectes americanus*

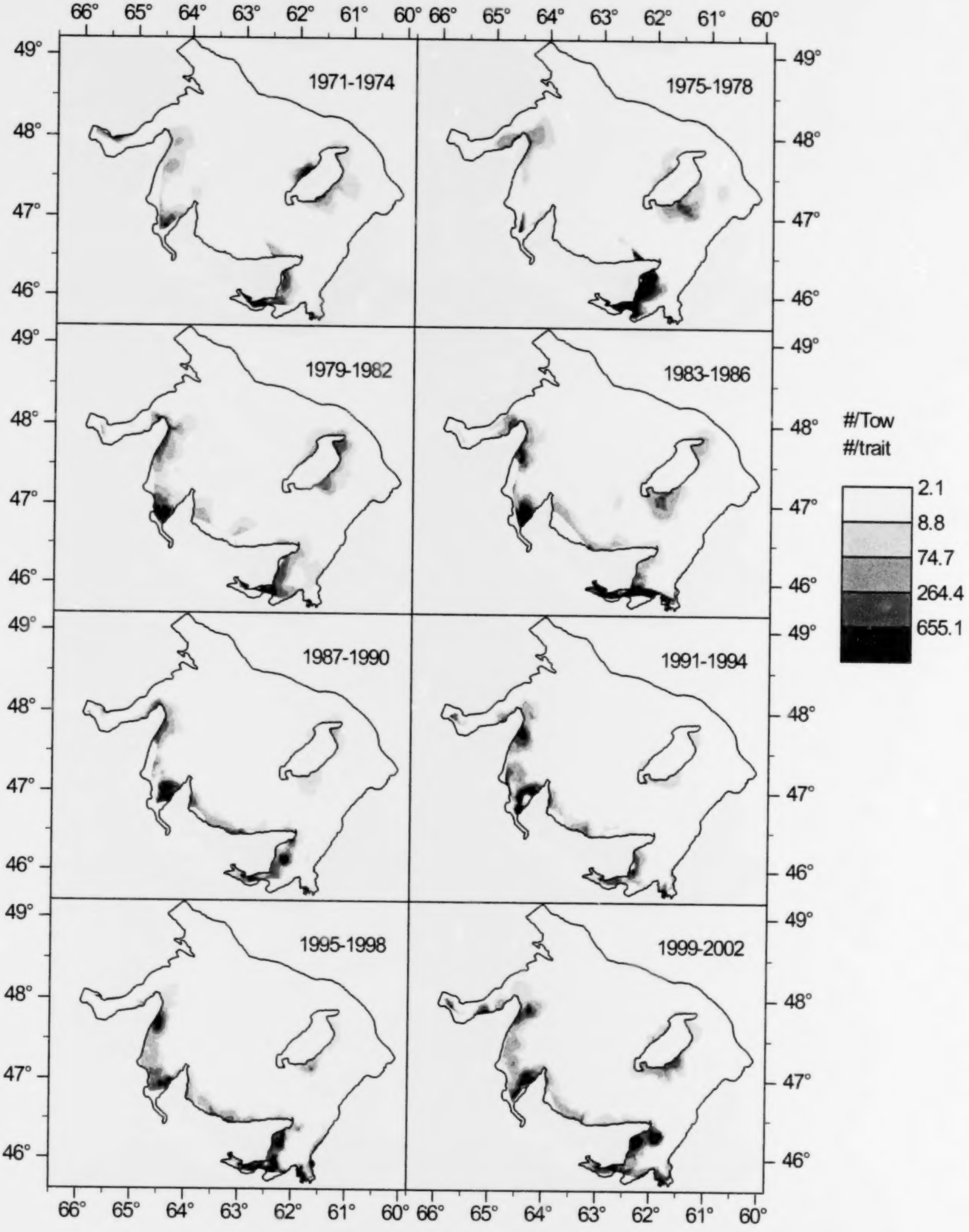

Figure 39b. September distribution of catches (#) of Winter Flounder, *Pseudopleuronectes americanus*

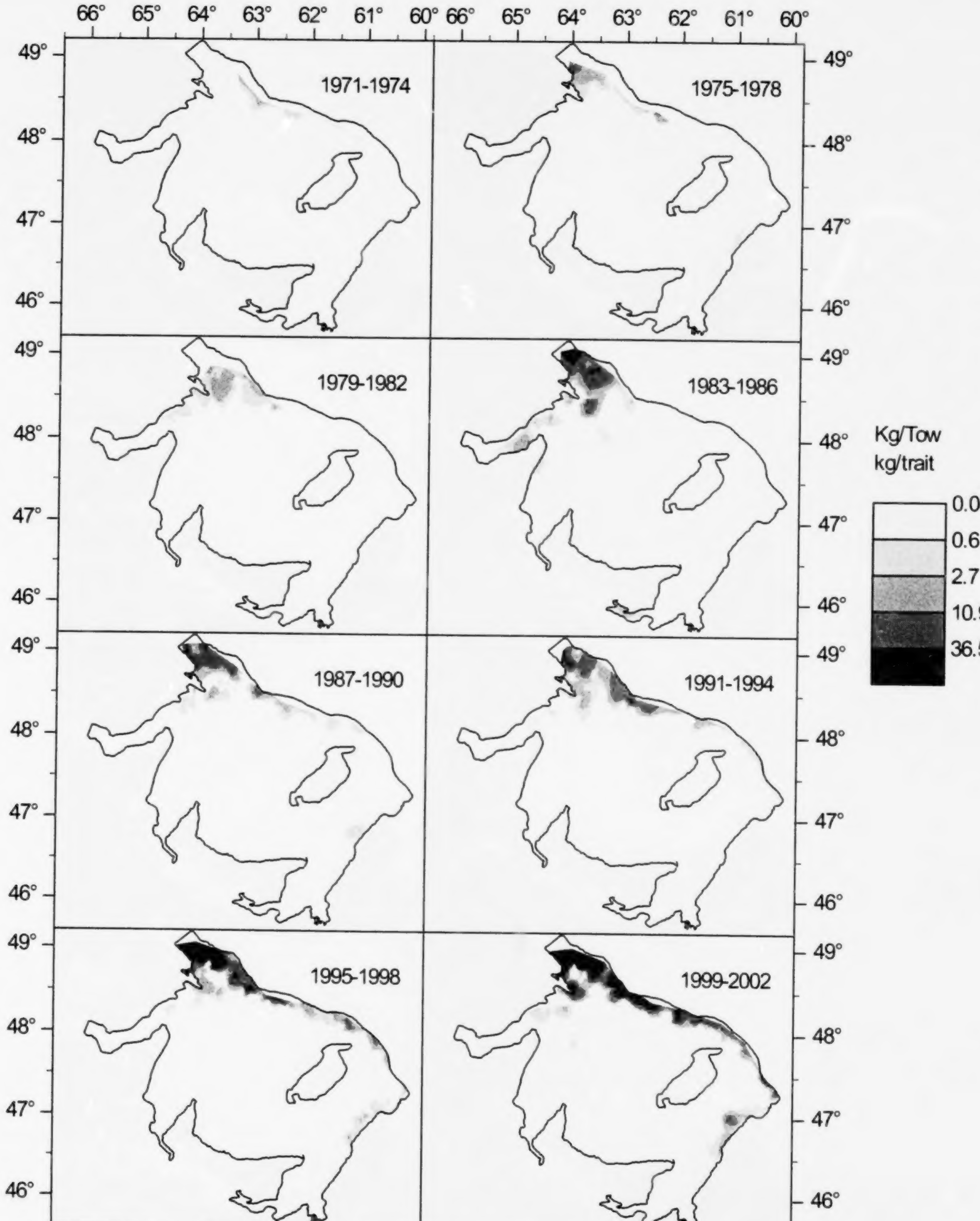

Figure 40a. September distribution of catches (kg) of Greendland Halibut, *Reinhardtius hippoglossoides*

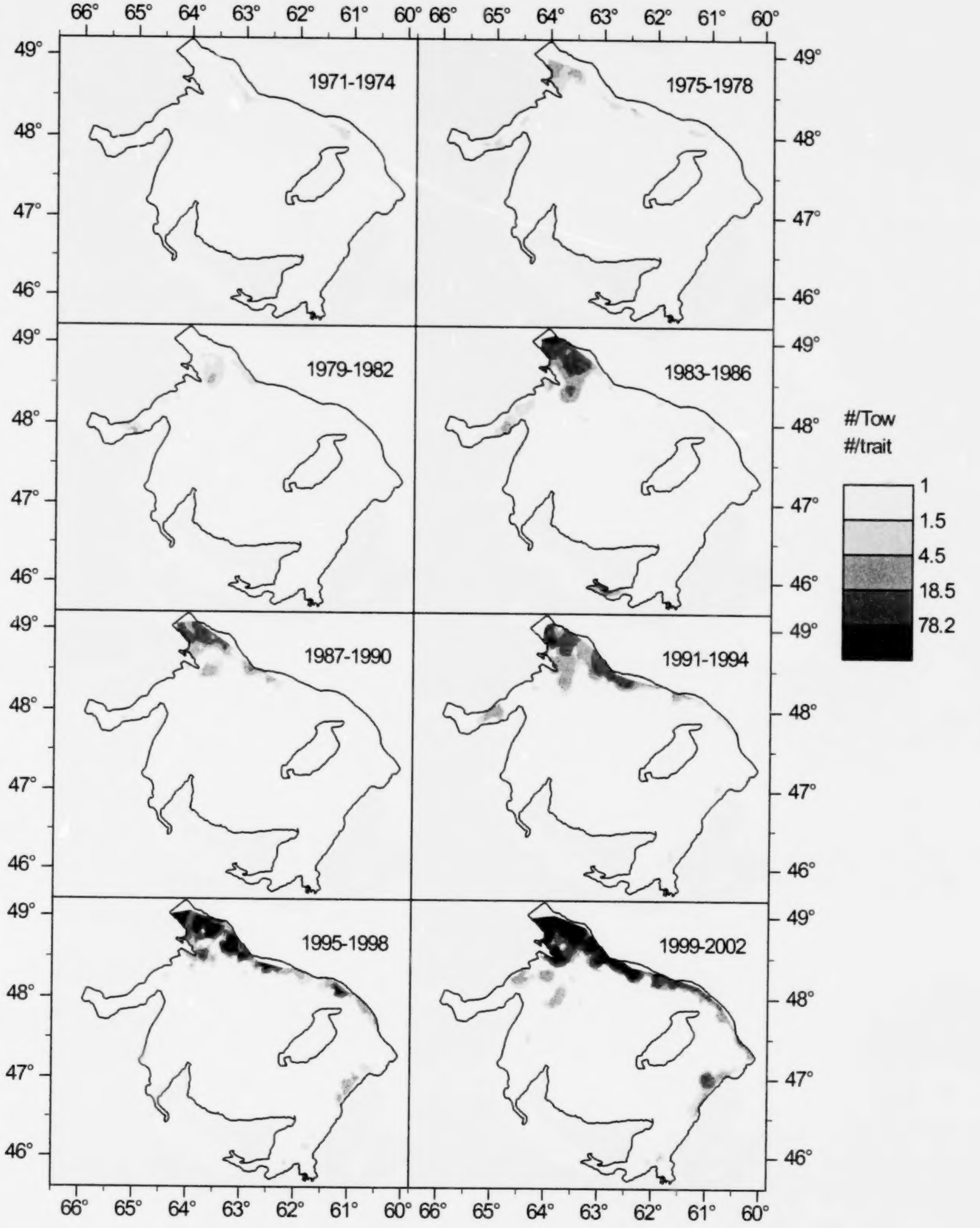

Figure 40b. September distribution of catches (#) of Greendland Halibut,
Reinhardtius hippoglossoides

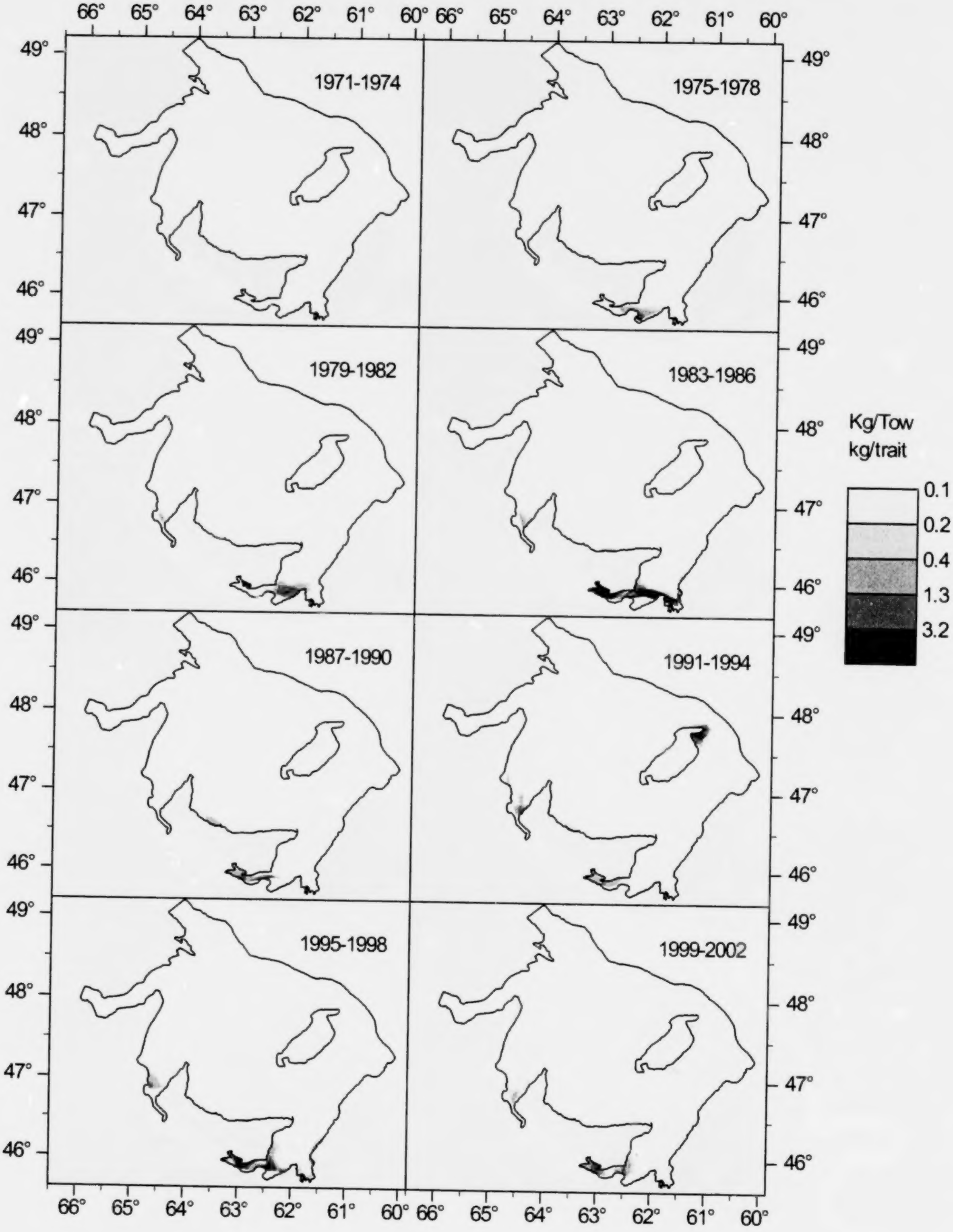

Figure 41a. September distribution of catches (kg) of Windowpane, *Scophthalmus aquosus*

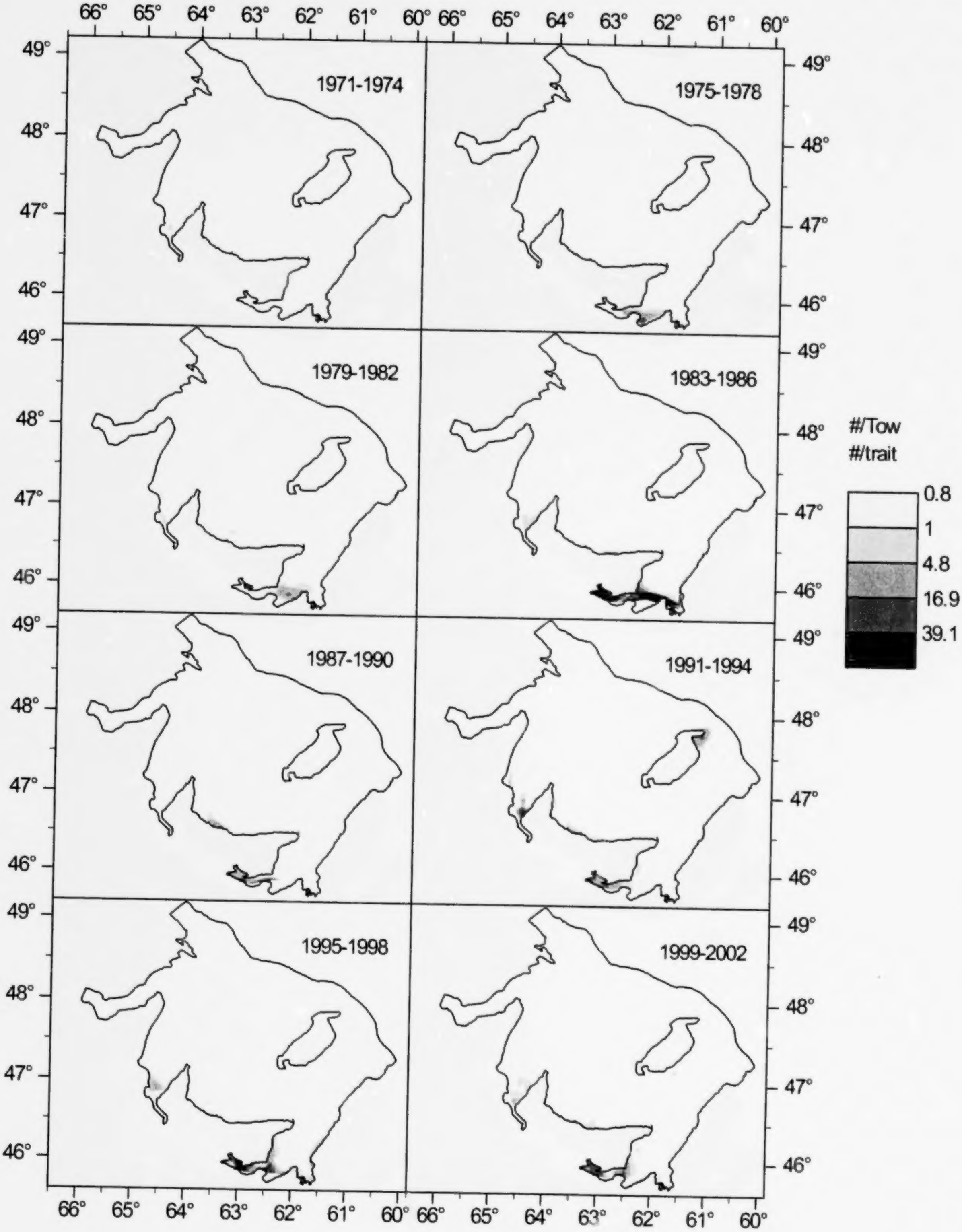

Figure 41b. September distribution of catches (#) of Windowpane, *Scophthalmus aquosus*

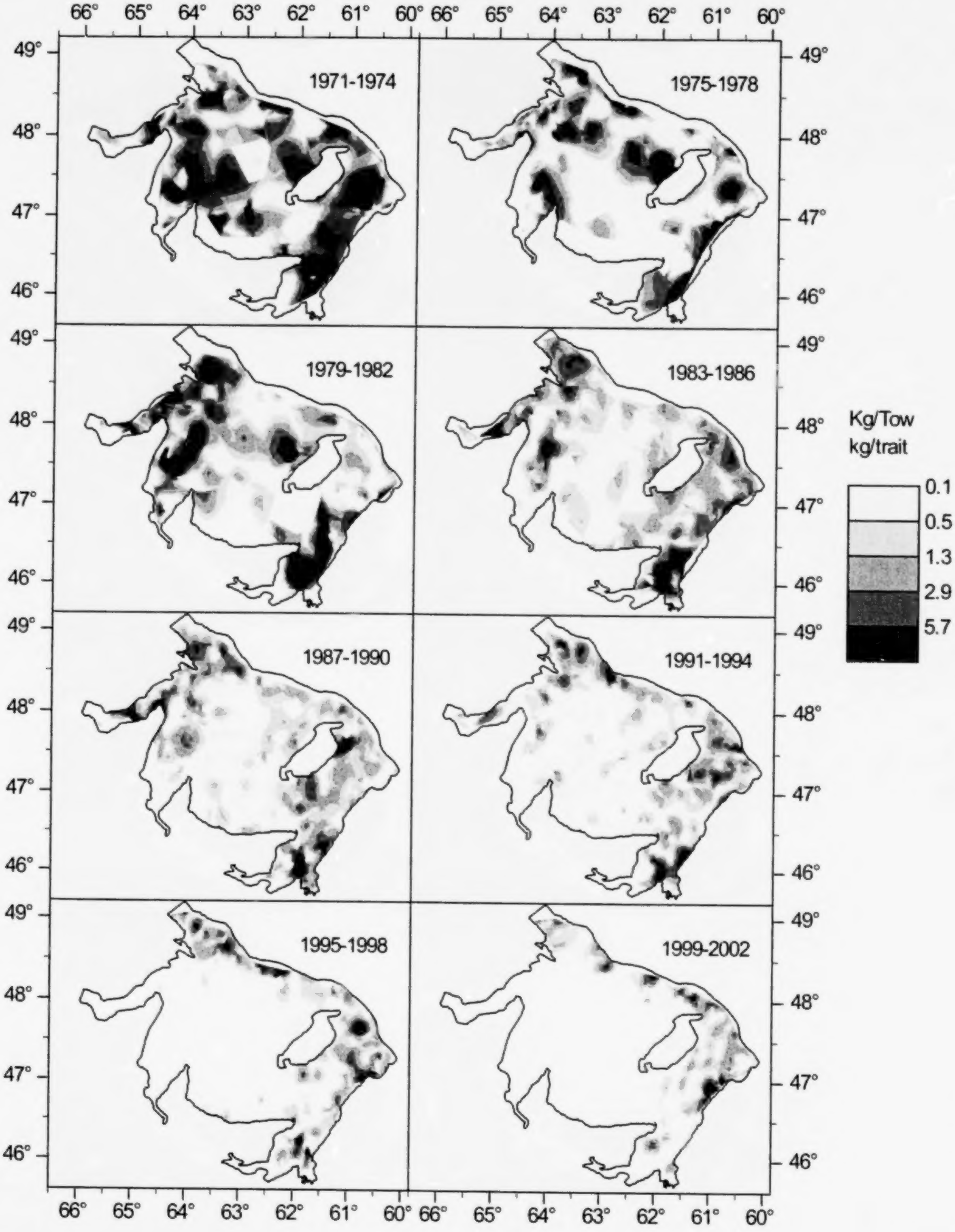

Figure 42a. September distribution of catches (kg) of Thorny Skate, *Amblyraja radiata*

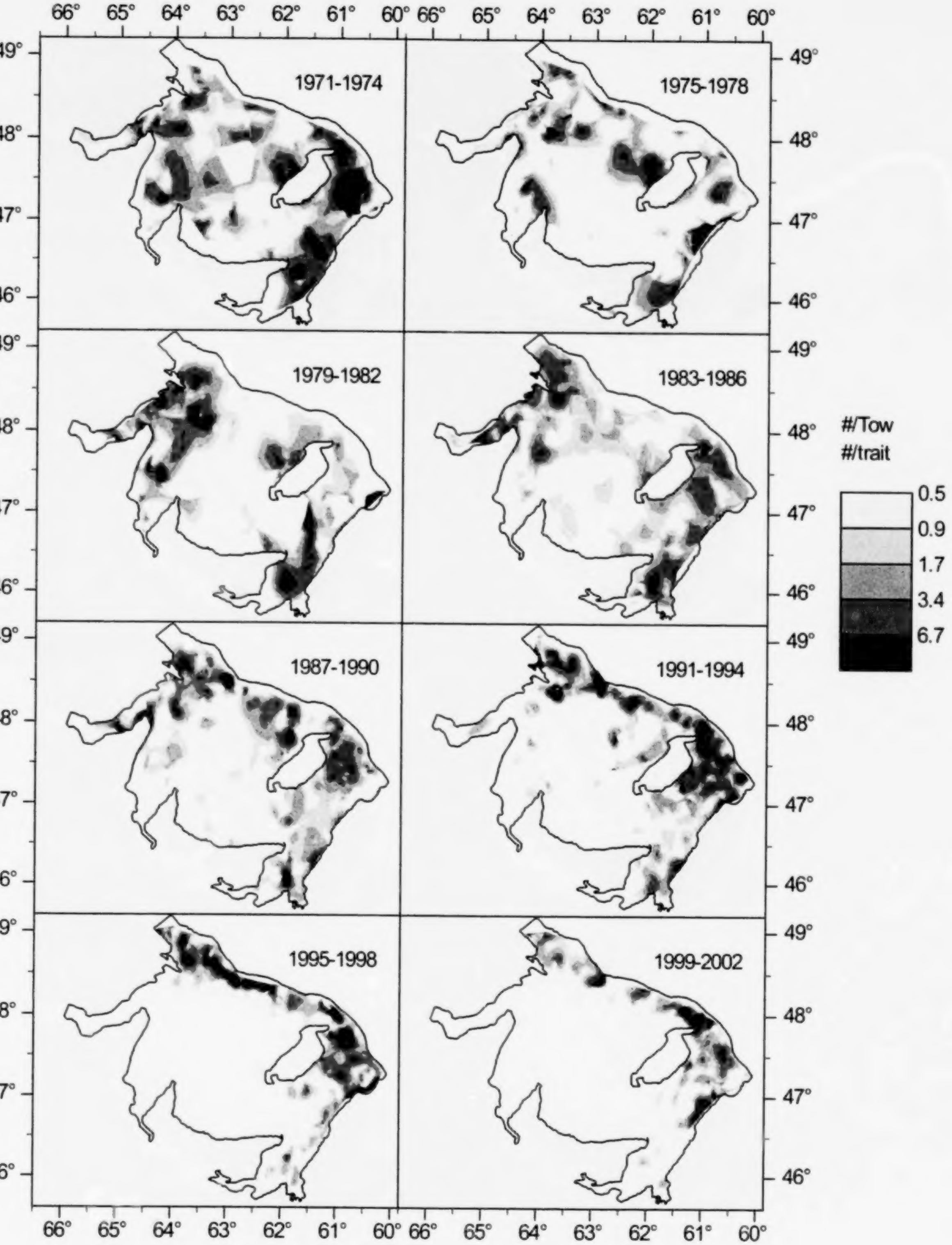

Figure 42b. September distribution of catches (#) of Thorny Skate, *Amblyraja radiata*

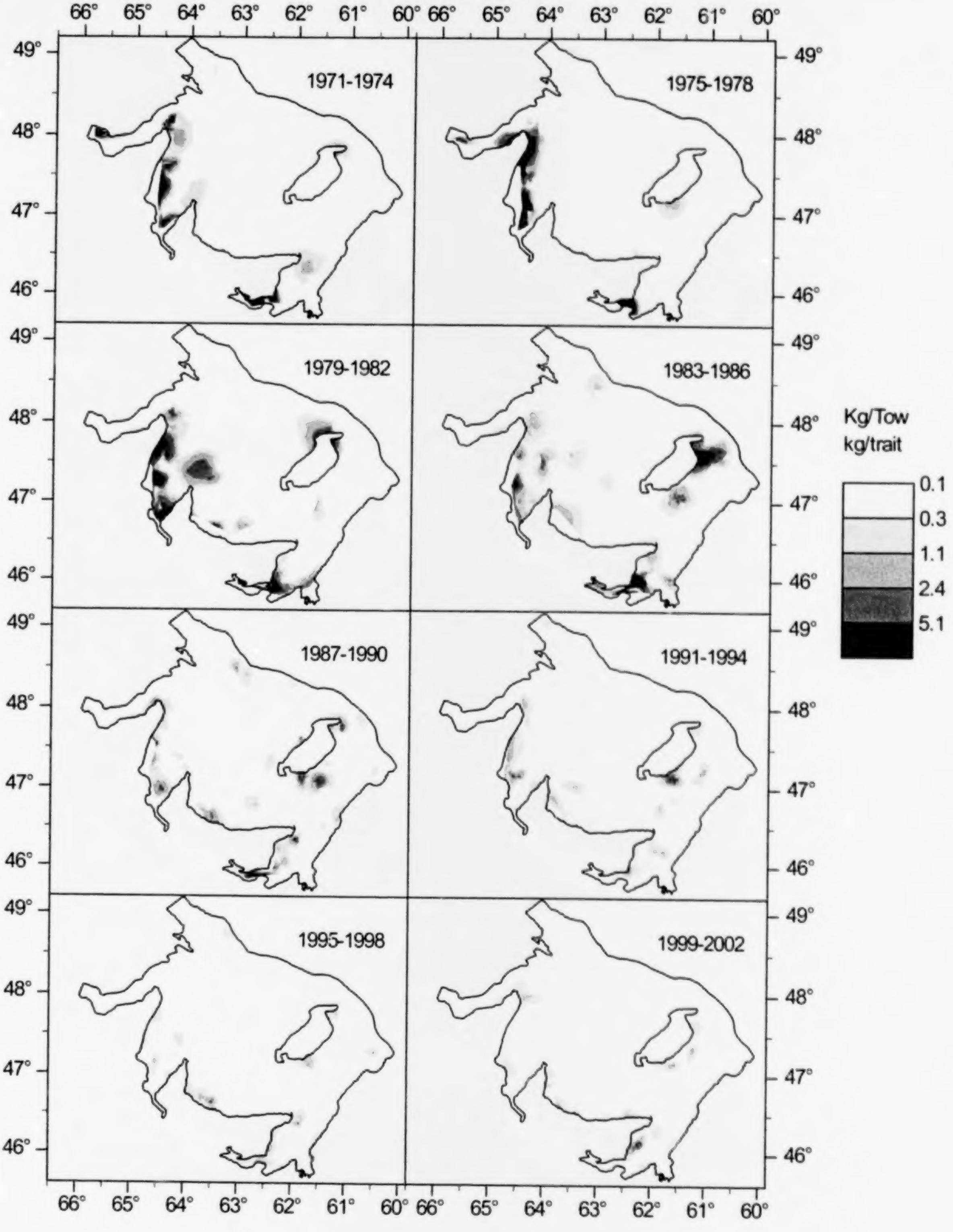

Figure 43a. September distribution of catches (kg) of Winter Skate, *Leucoraja ocellata*

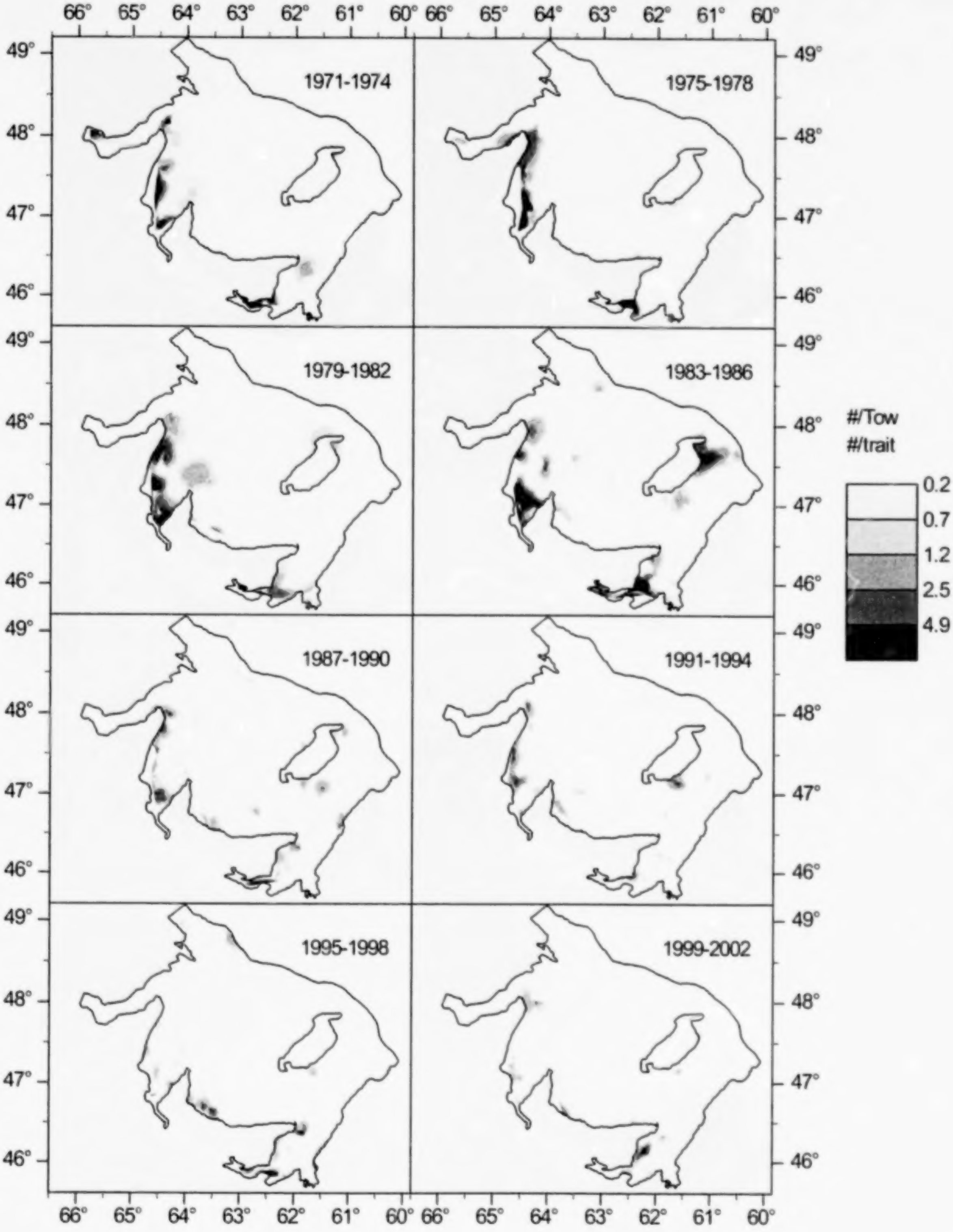

Figure 43b. September distribution of catches (#) of Winter Skate, *Leucoraja ocellata*

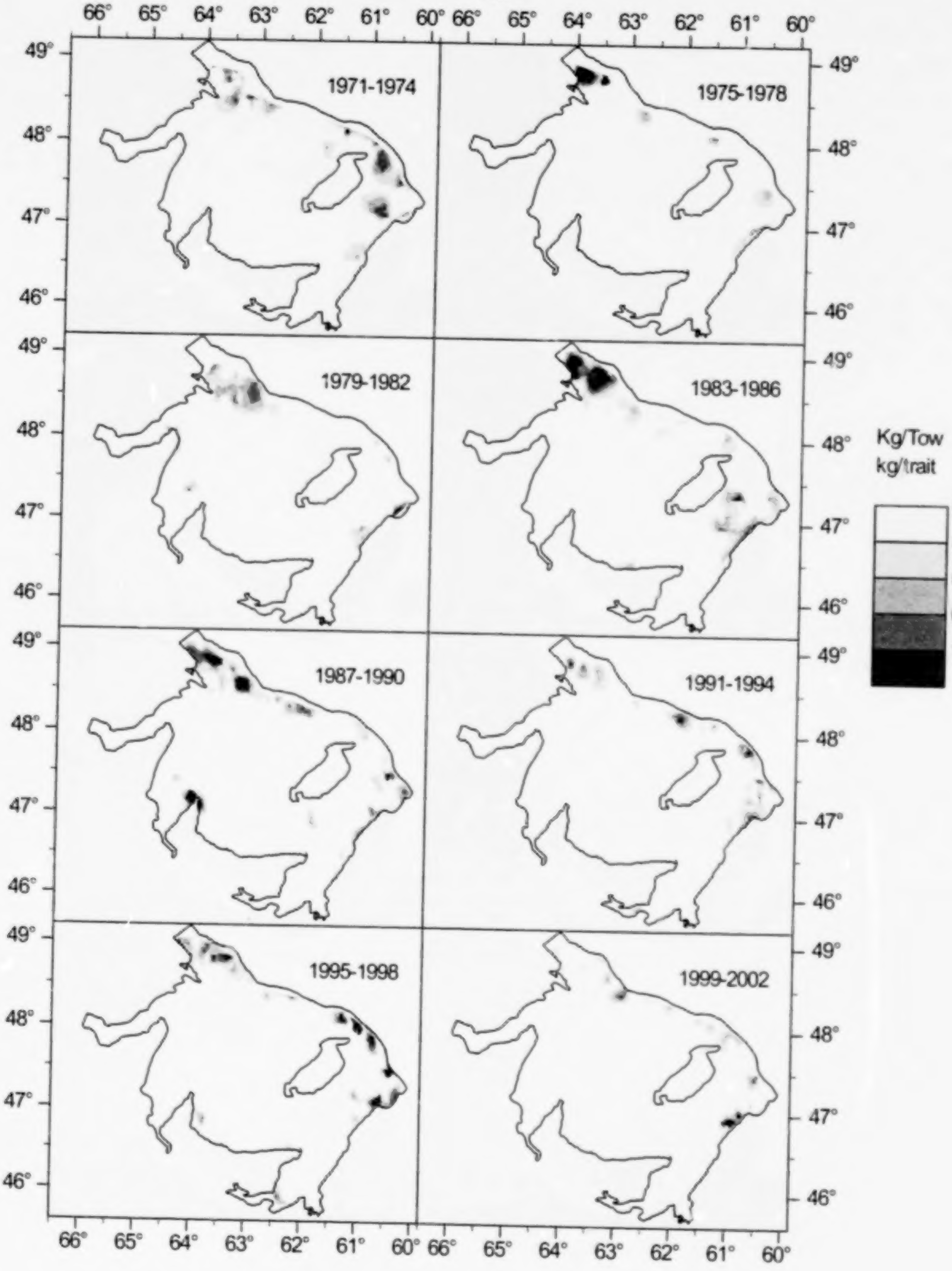

Figure 44a. September distribution of catches (kg) of Smooth Skate, *Malacoraja senta*

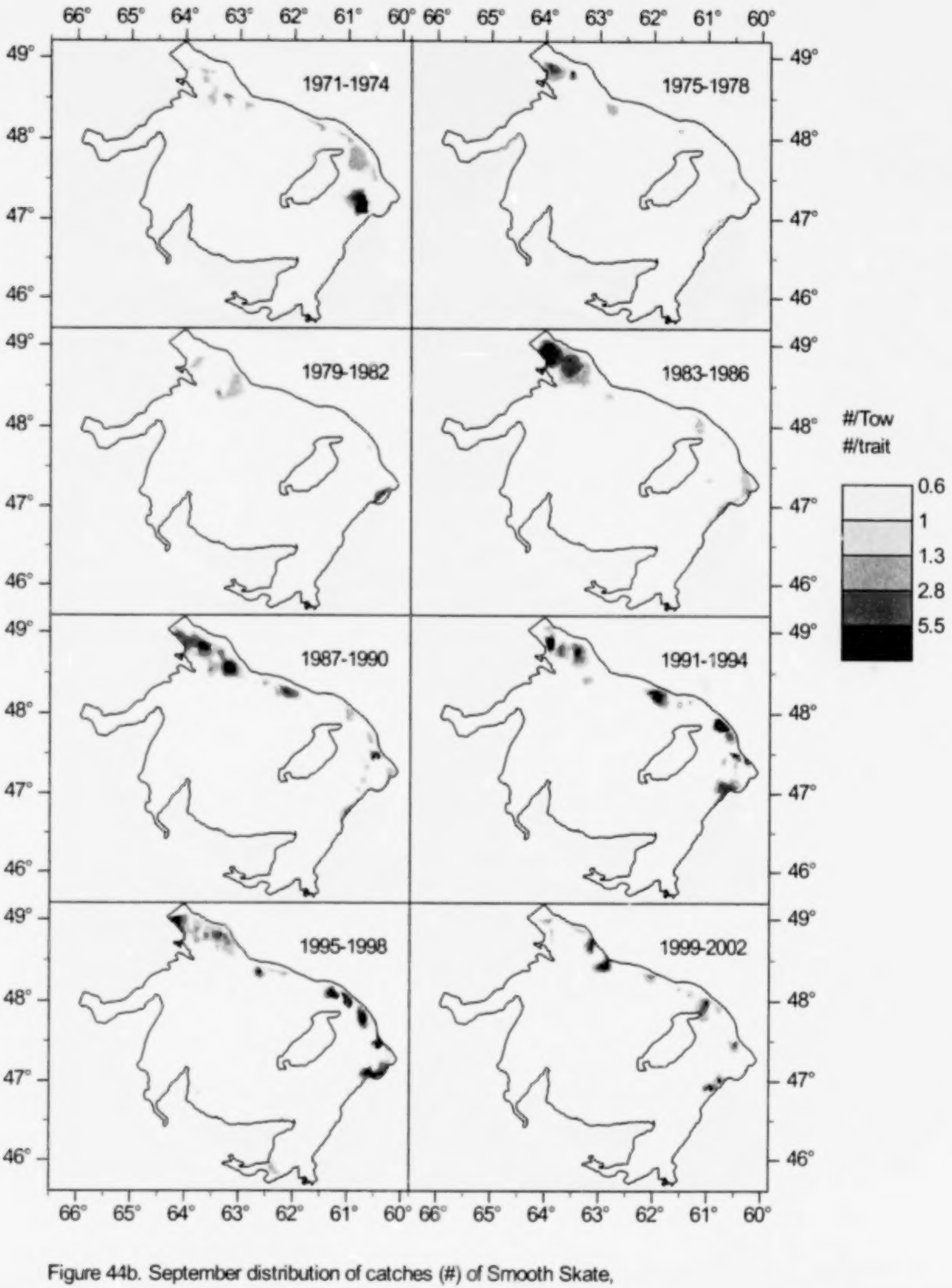

Figure 44b. September distribution of catches (#) of Smooth Skate, *Malacoraja senta*

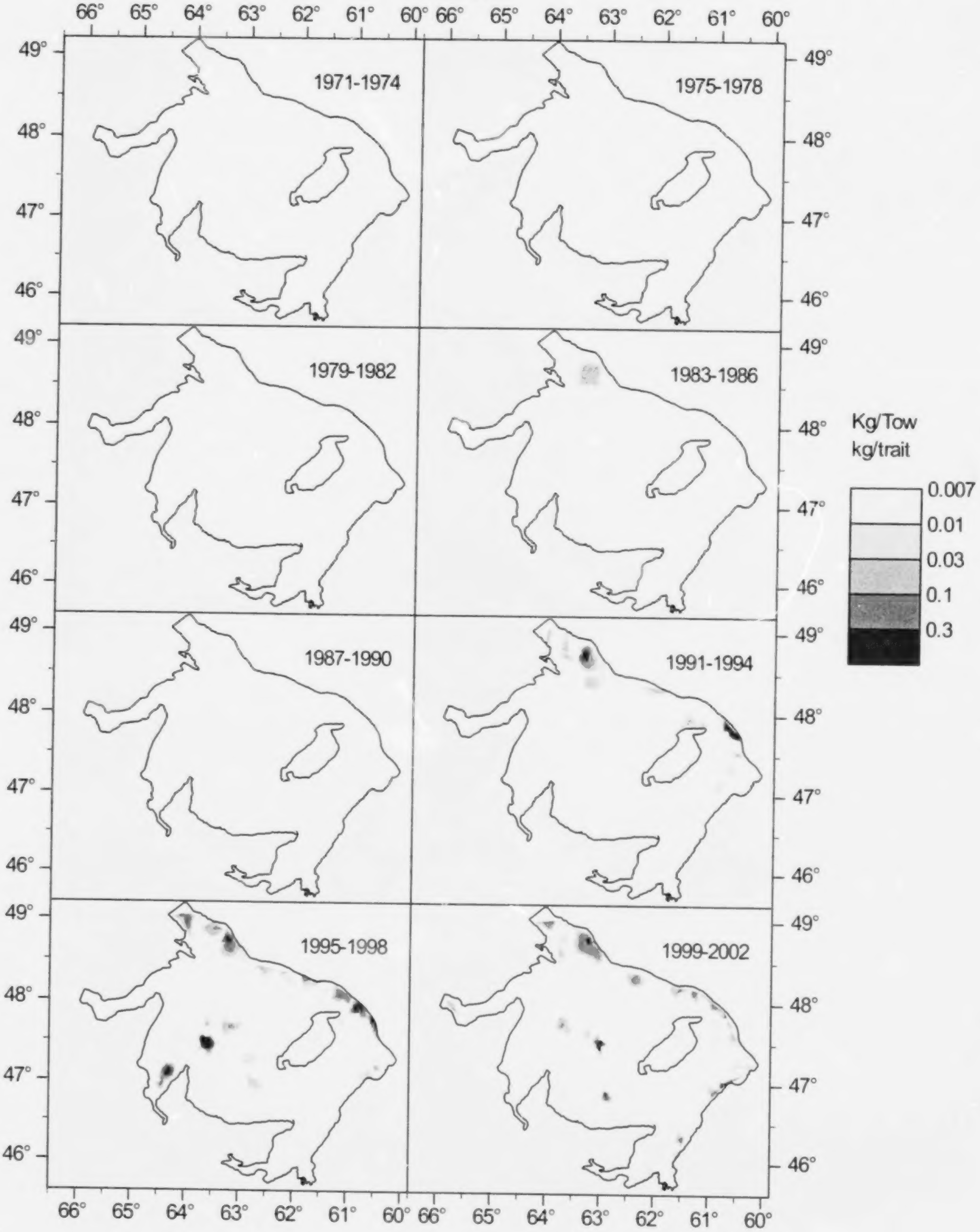

Figure 44c. September distribution of catches (kg) of Skate Egg Cases.

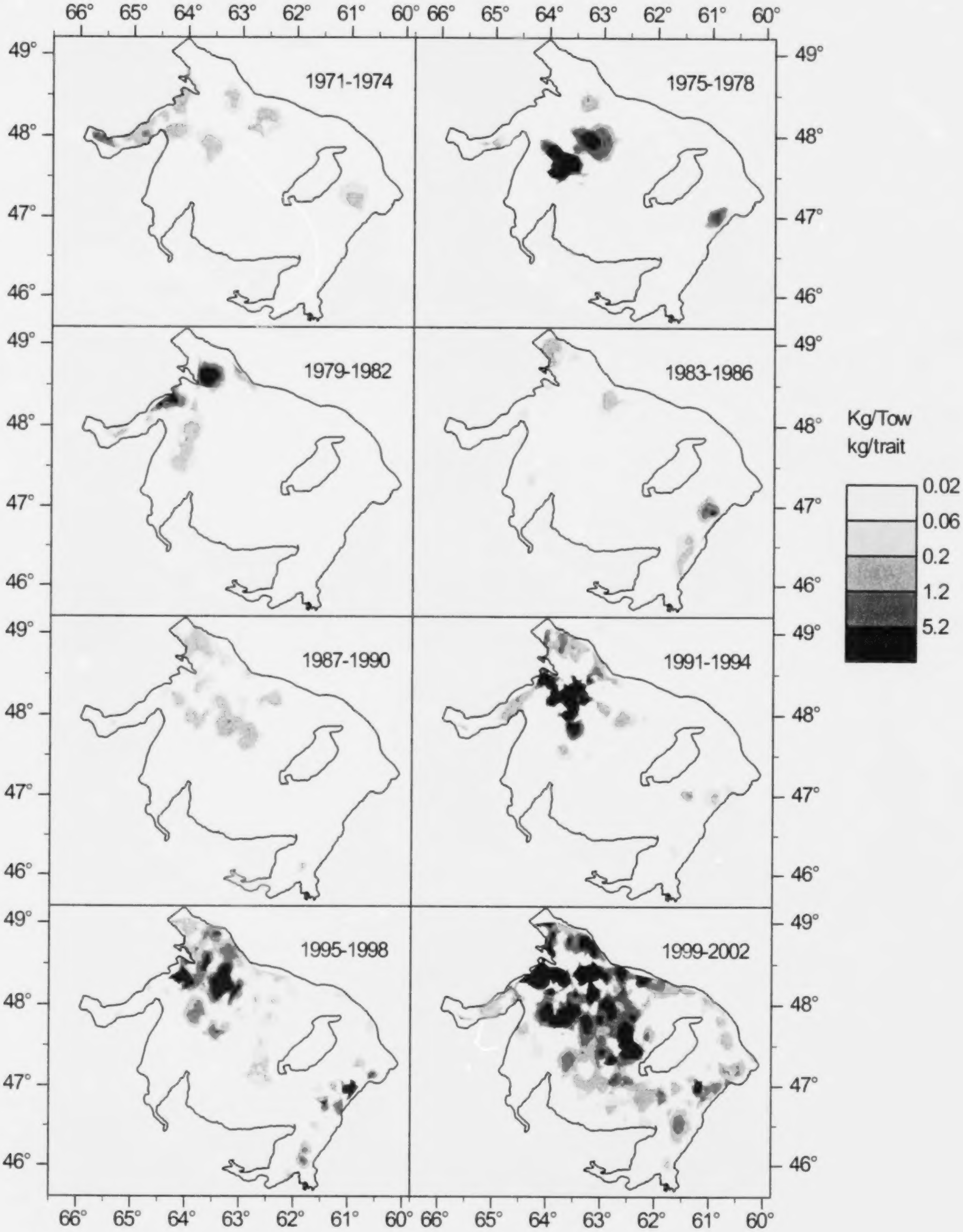

Figure 45a. September distribution of catches (kg) of Capelin, *Mallotus villosus*

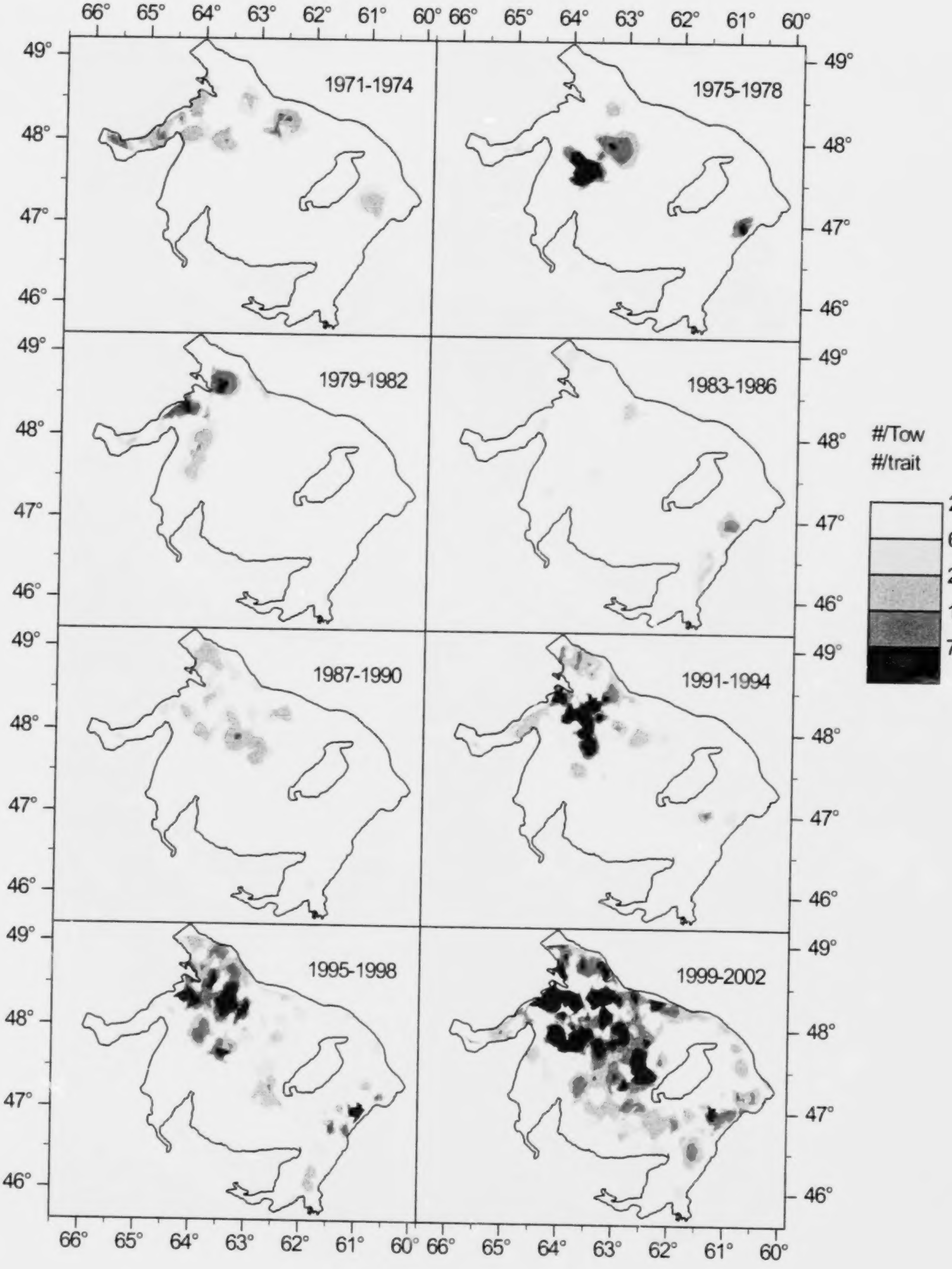

Figure 45b. September distribution of catches (#) of Capelin, *Mallotus villosus*

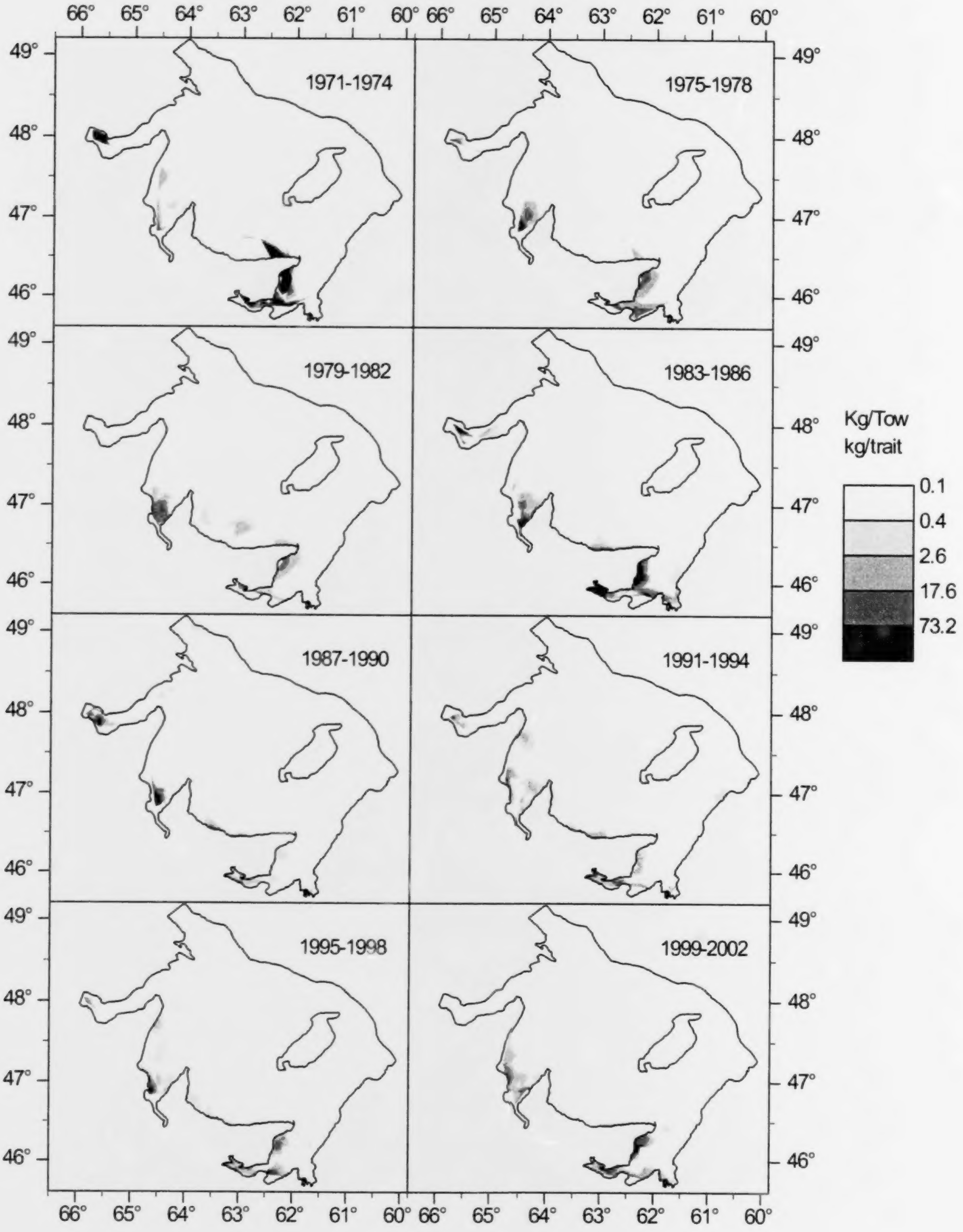

Figure 46a. September distribution of catches (kg) of Rainbow Smelt, *Osmerus mordax*

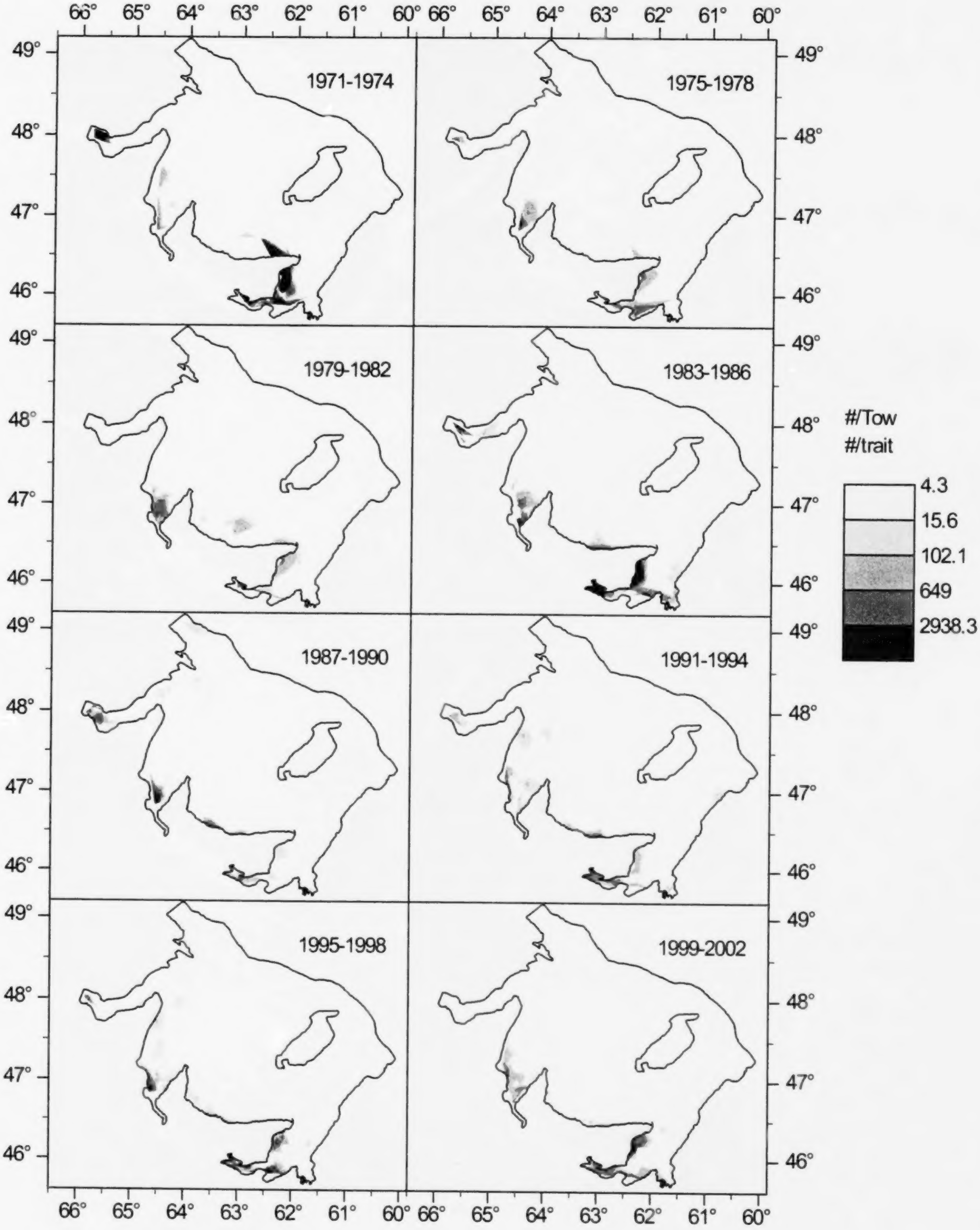

Figure 46b. September distribution of catches (#) of Rainbow Smelt, *Osmerus mordax*

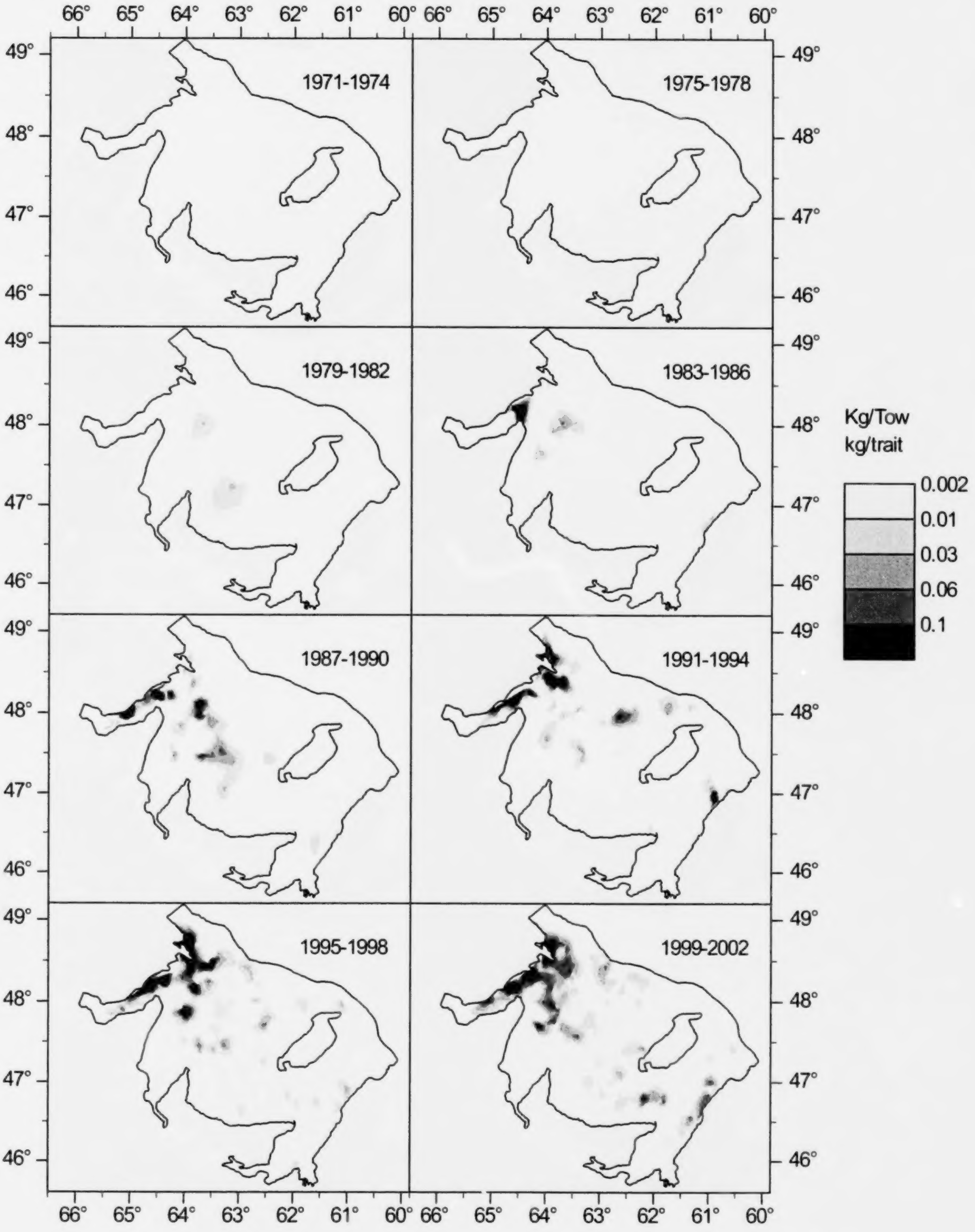

Figure 47a. September distribution of catches (kg) of Atlantic Sea Poacher, *Leptagonus decagonus*

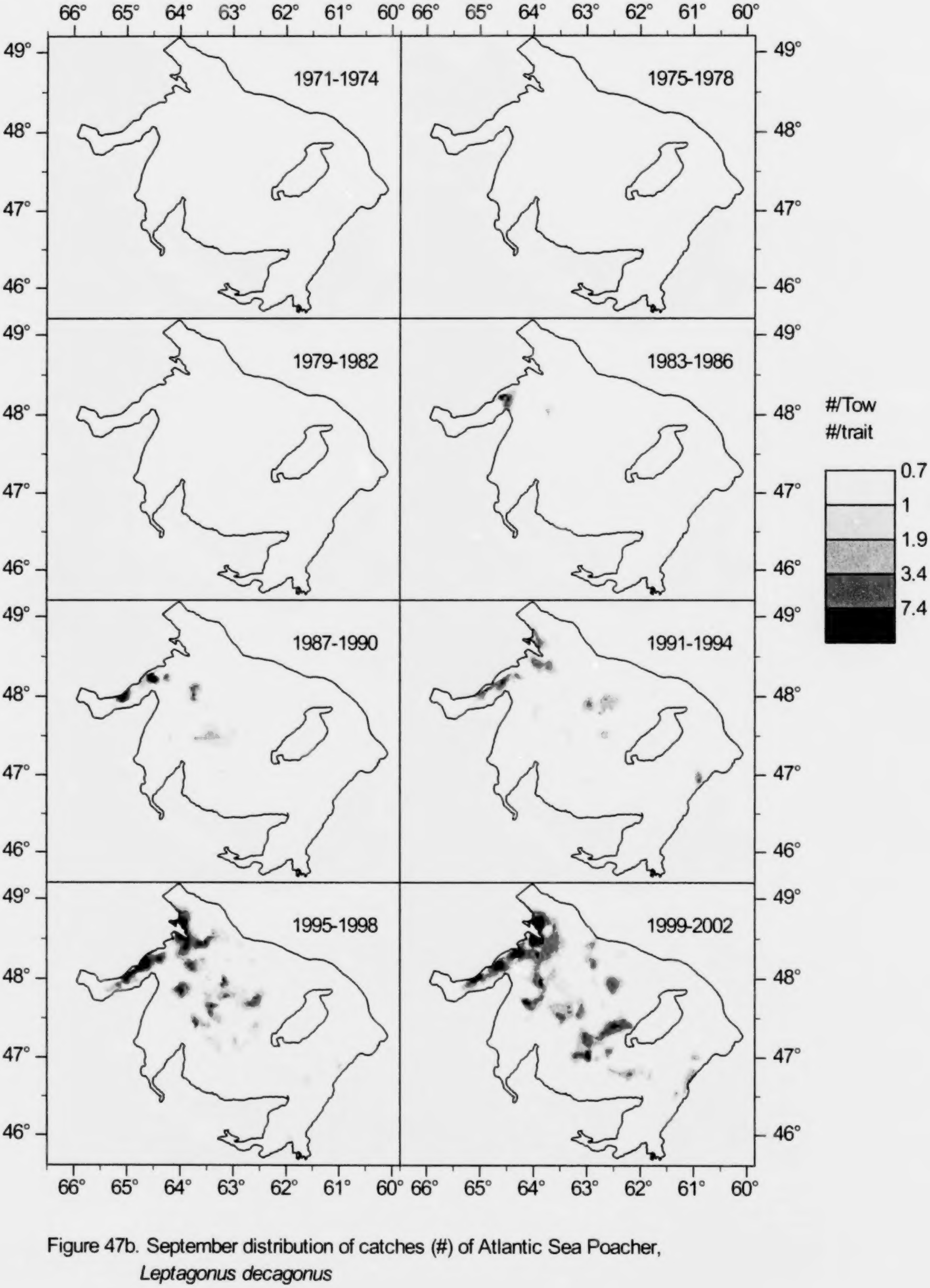

Figure 47b. September distribution of catches (#) of Atlantic Sea Poacher, *Leptagonus decagonus*

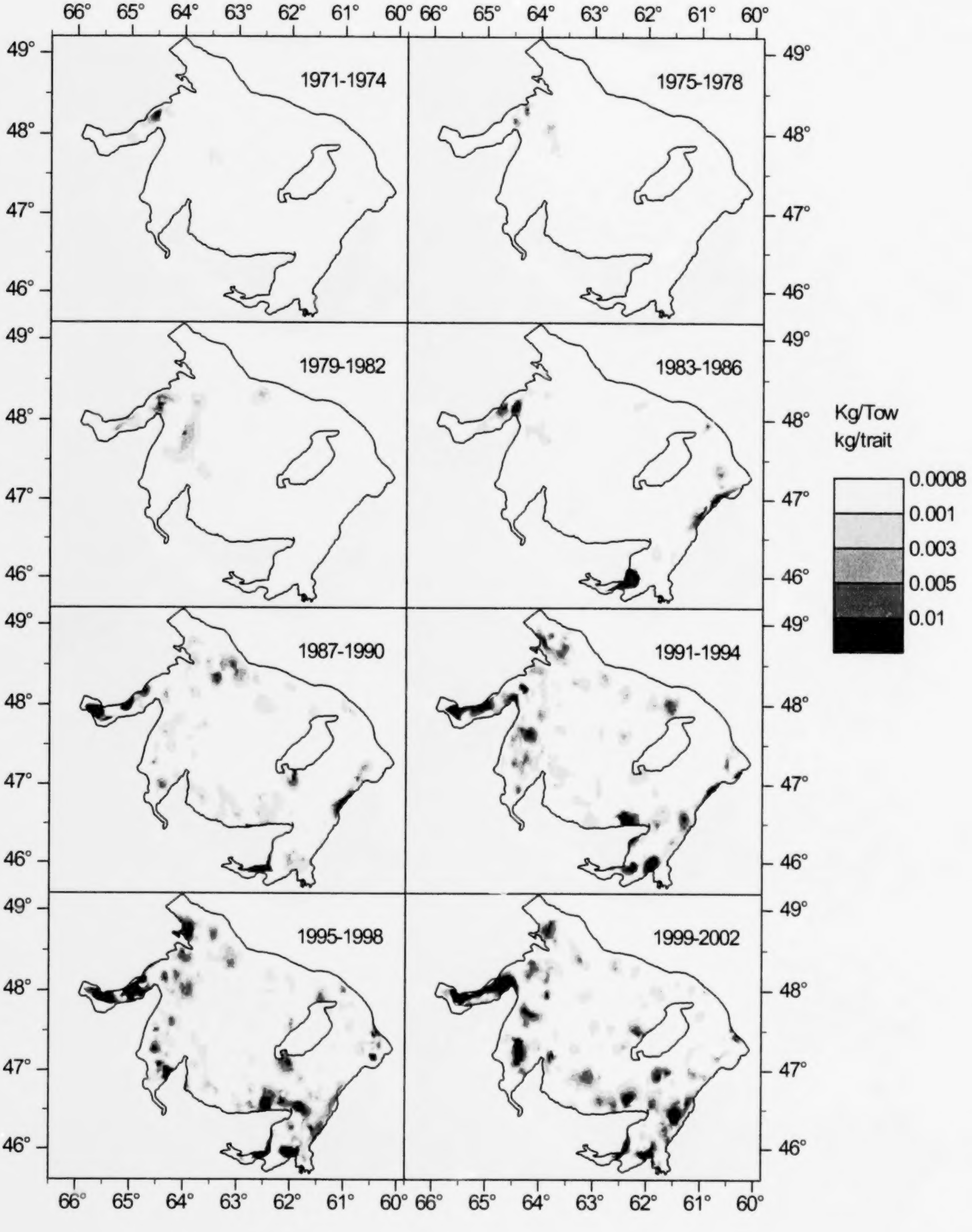

Figure 48a. September distribution of catches (kg) of Alligatorfish, *Aspidophoroides monopterygius*

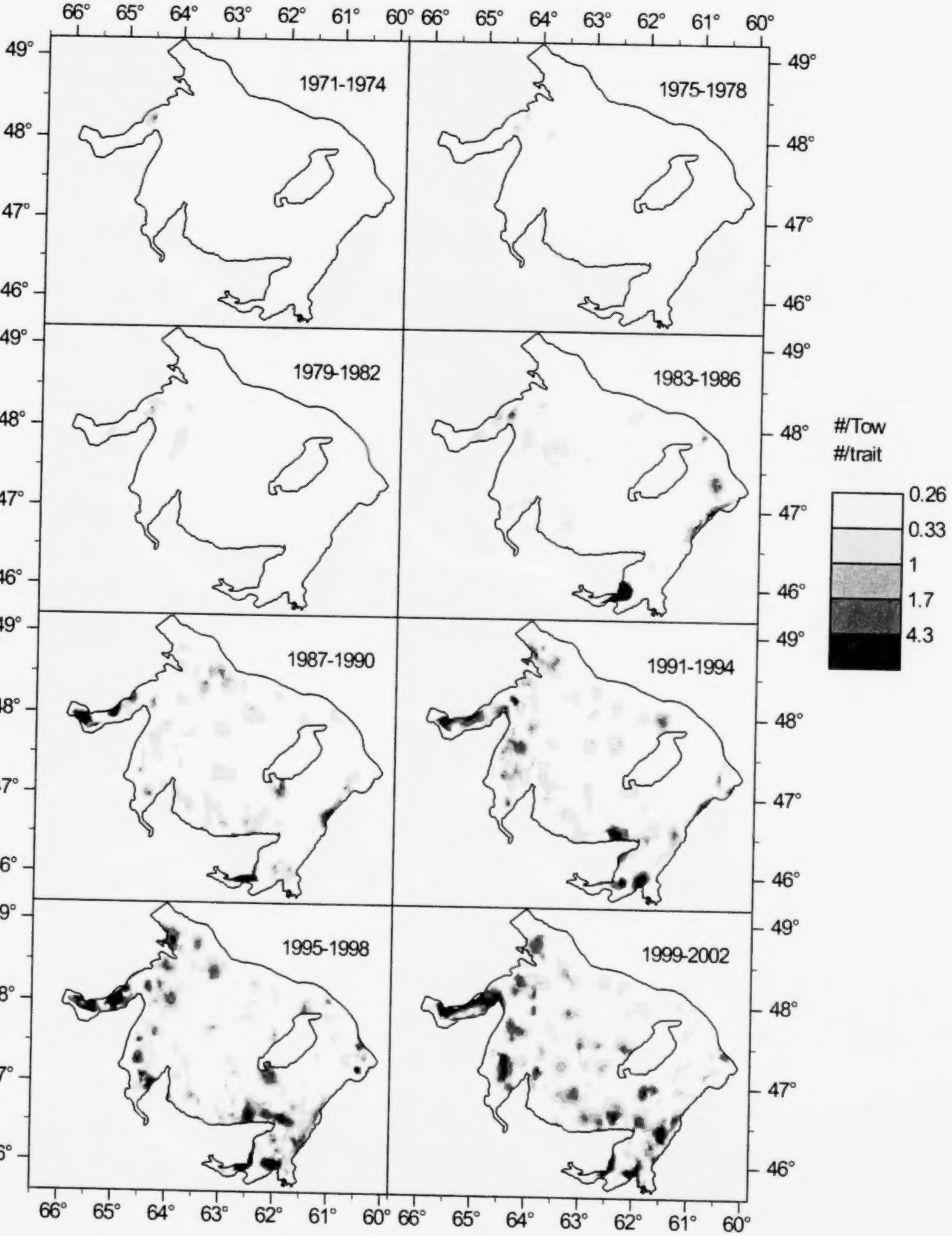

Figure 48b. September distribution of catches (#) of Alligatorfish, *Aspidophoroides monopterygius*

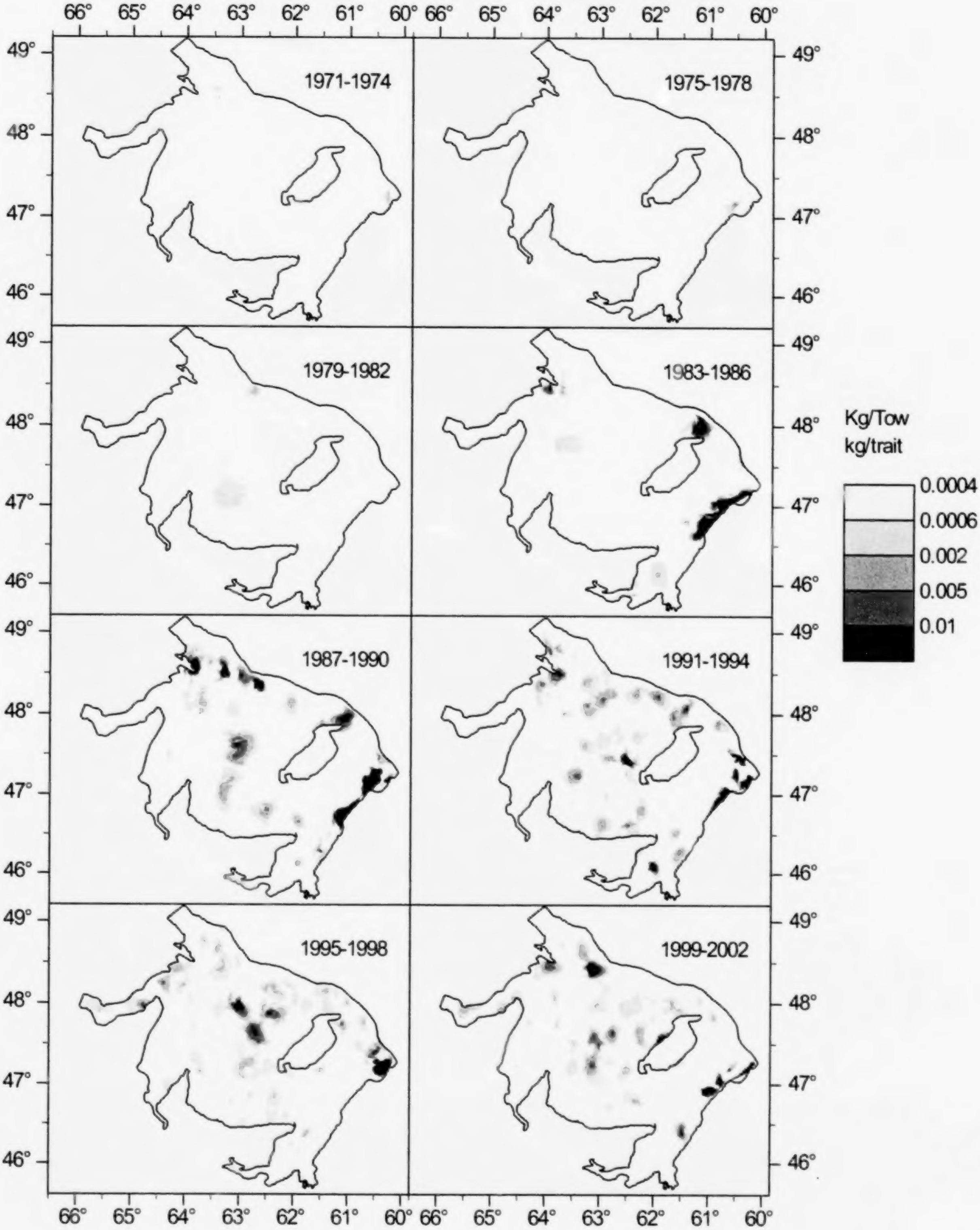

Figure 49a. September distribution of catches (kg) of Arctic Hookear Sculpin, *Artediellus uncinatus*

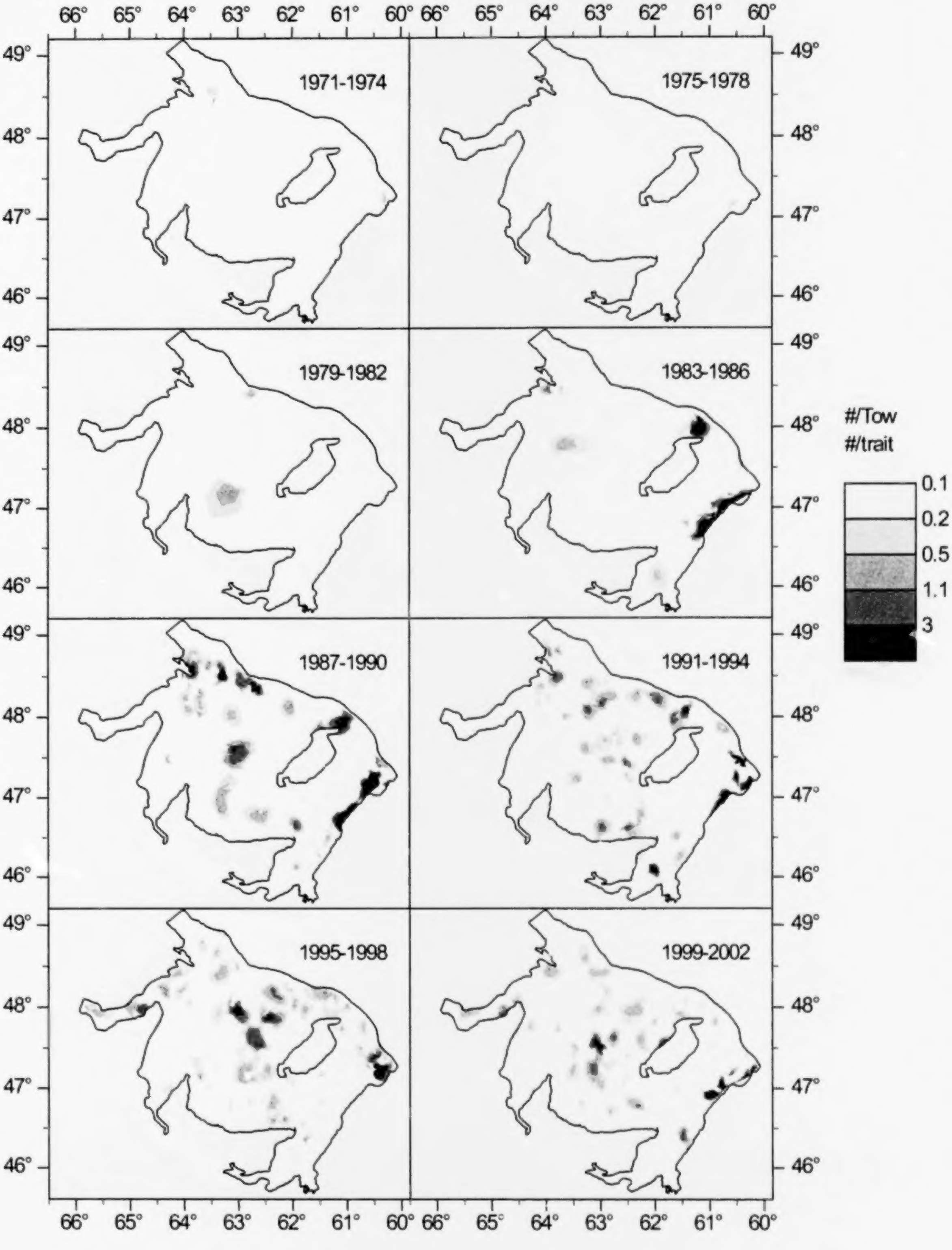

Figure 49b. September distribution of catches (#) of Arctic Hookear Sculpin, *Artediellus uncinatus*

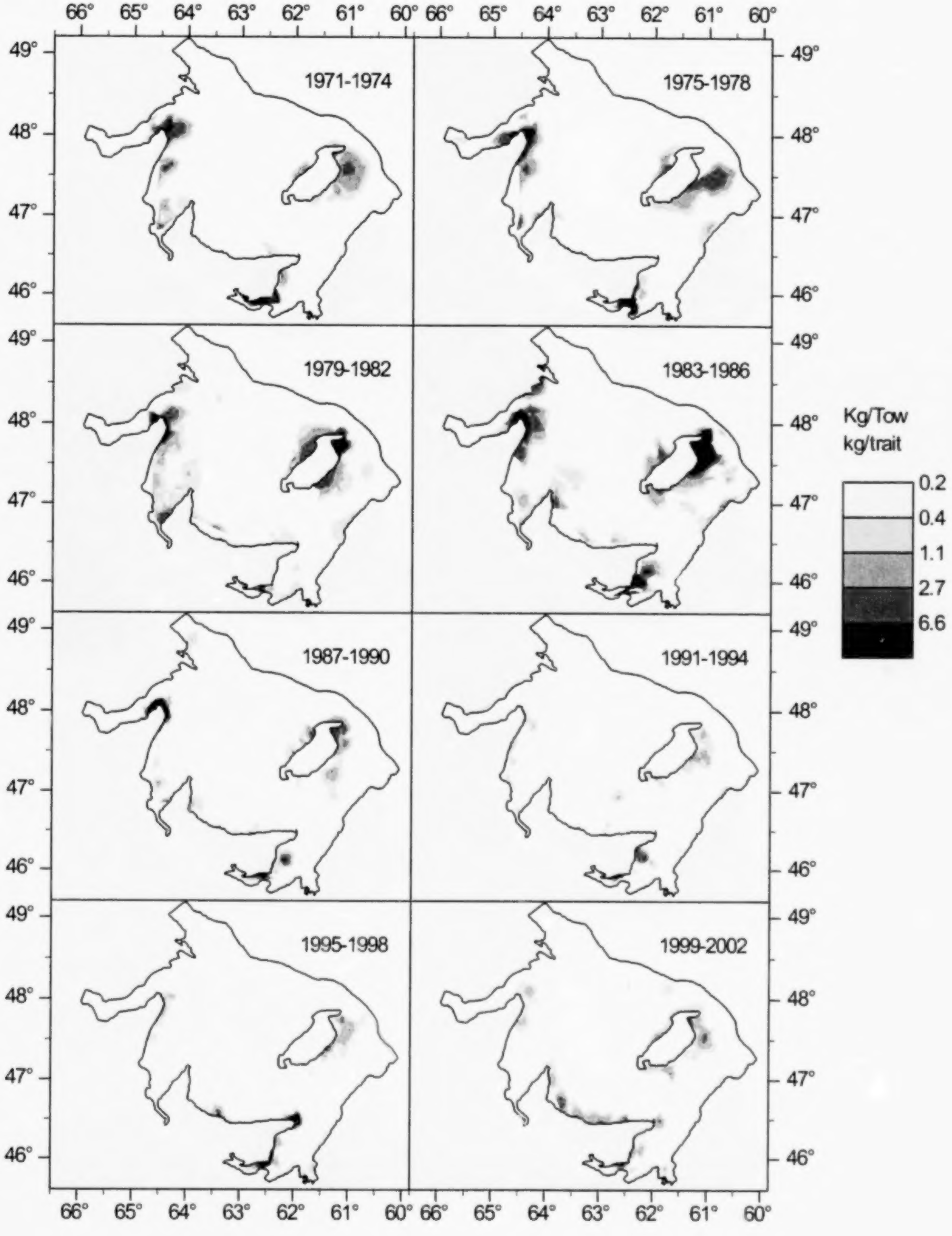

Figure 50a. September distribution of catches (kg) of Sea Raven, *Hemitripterus americanus*

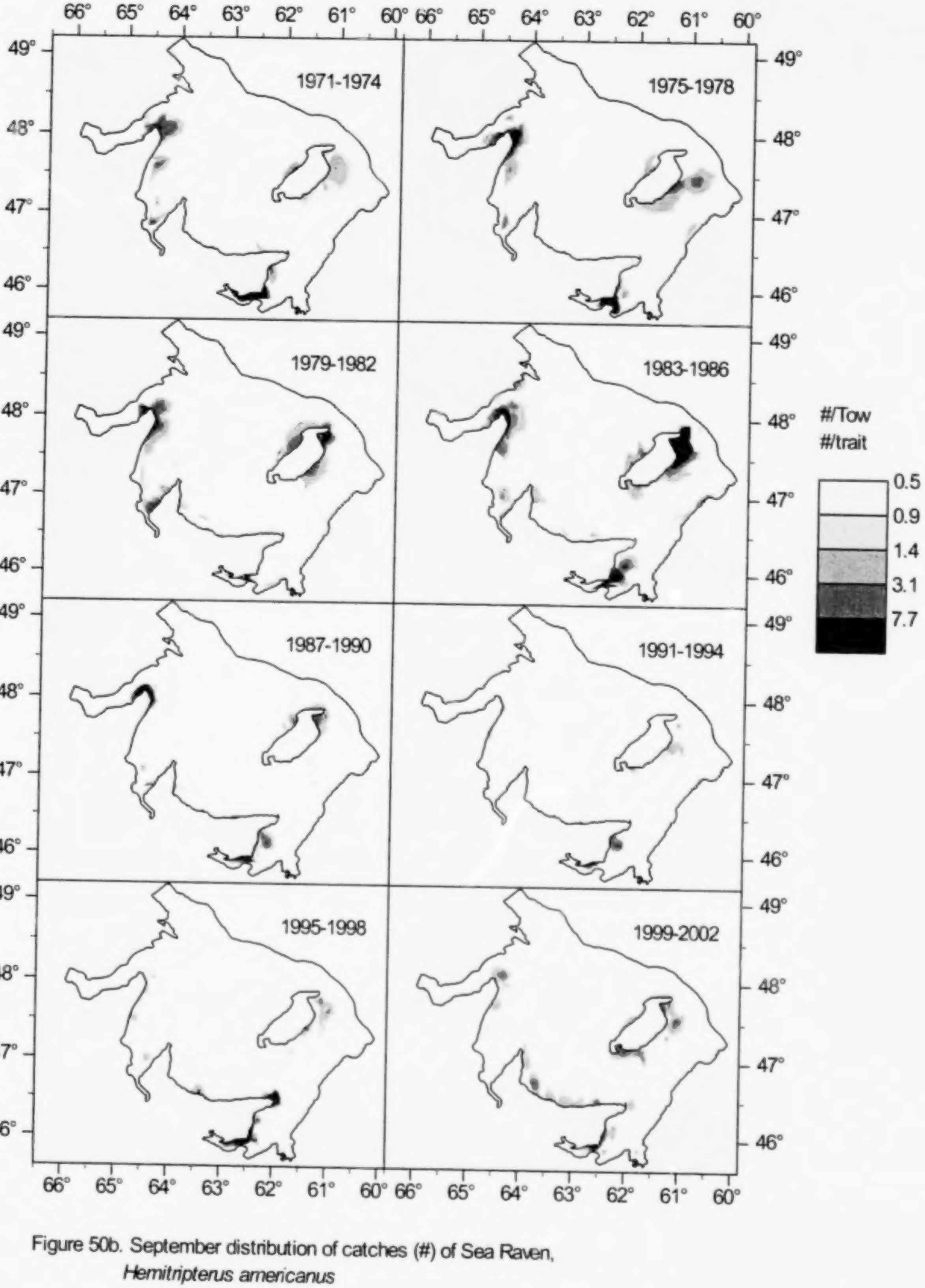

Figure 50b. September distribution of catches (#) of Sea Raven, *Hemitripterus americanus*

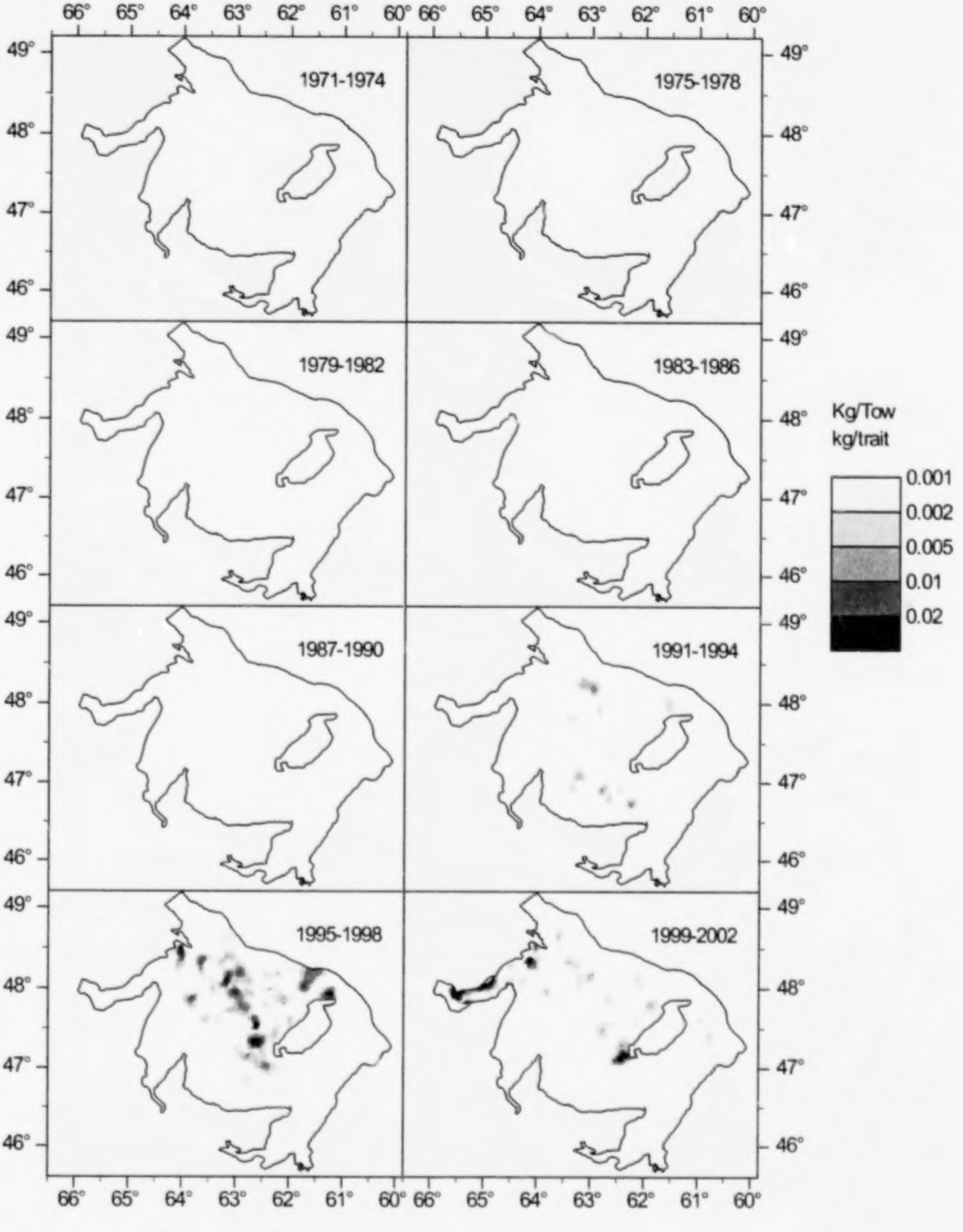

Figure 51a. September distribution of catches (kg) of Spatulate Sculpin, *Icelus spatula*

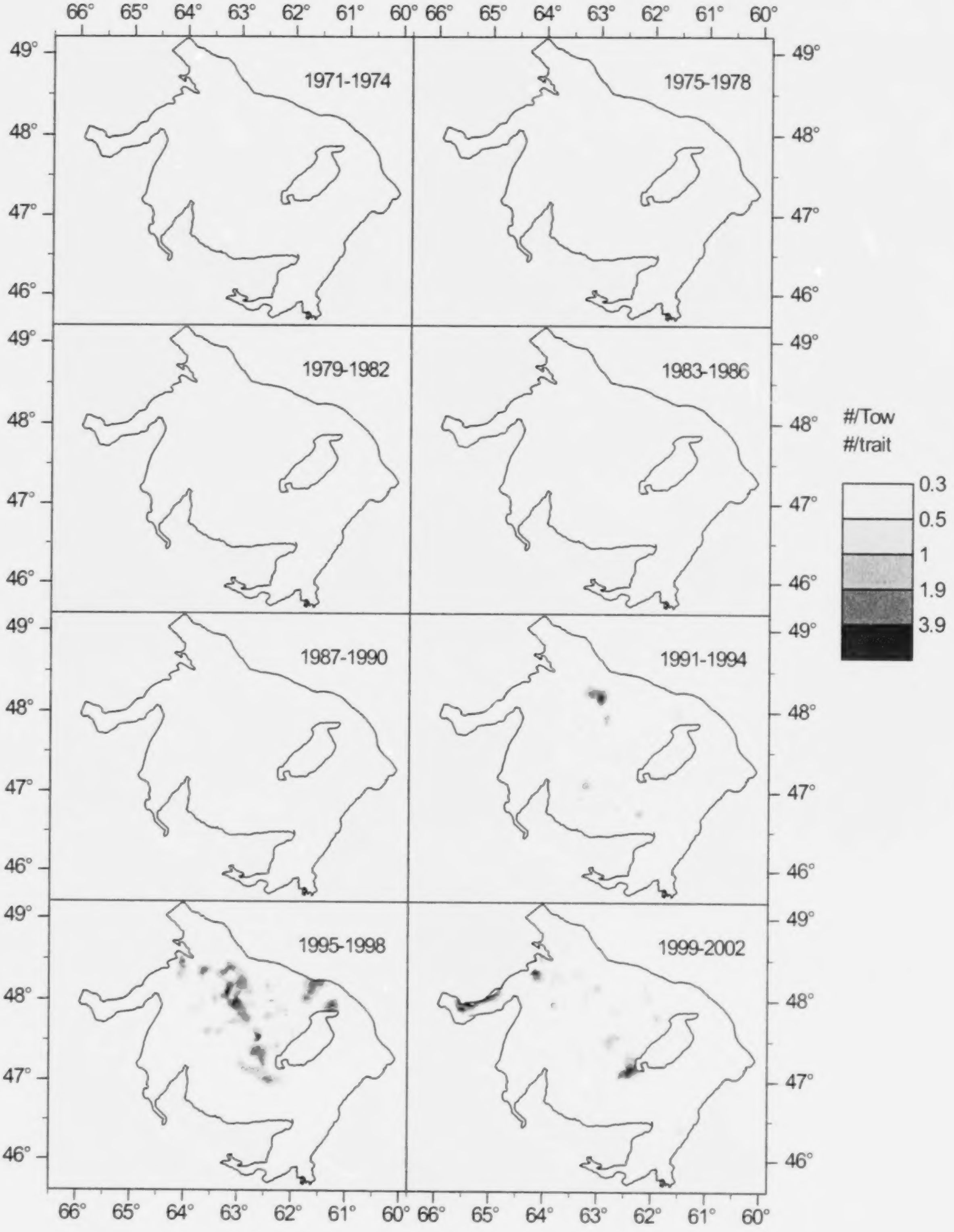

Figure 51b. September distribution of catches (#) of Spatulate Sculpin, *Icelus spatula*

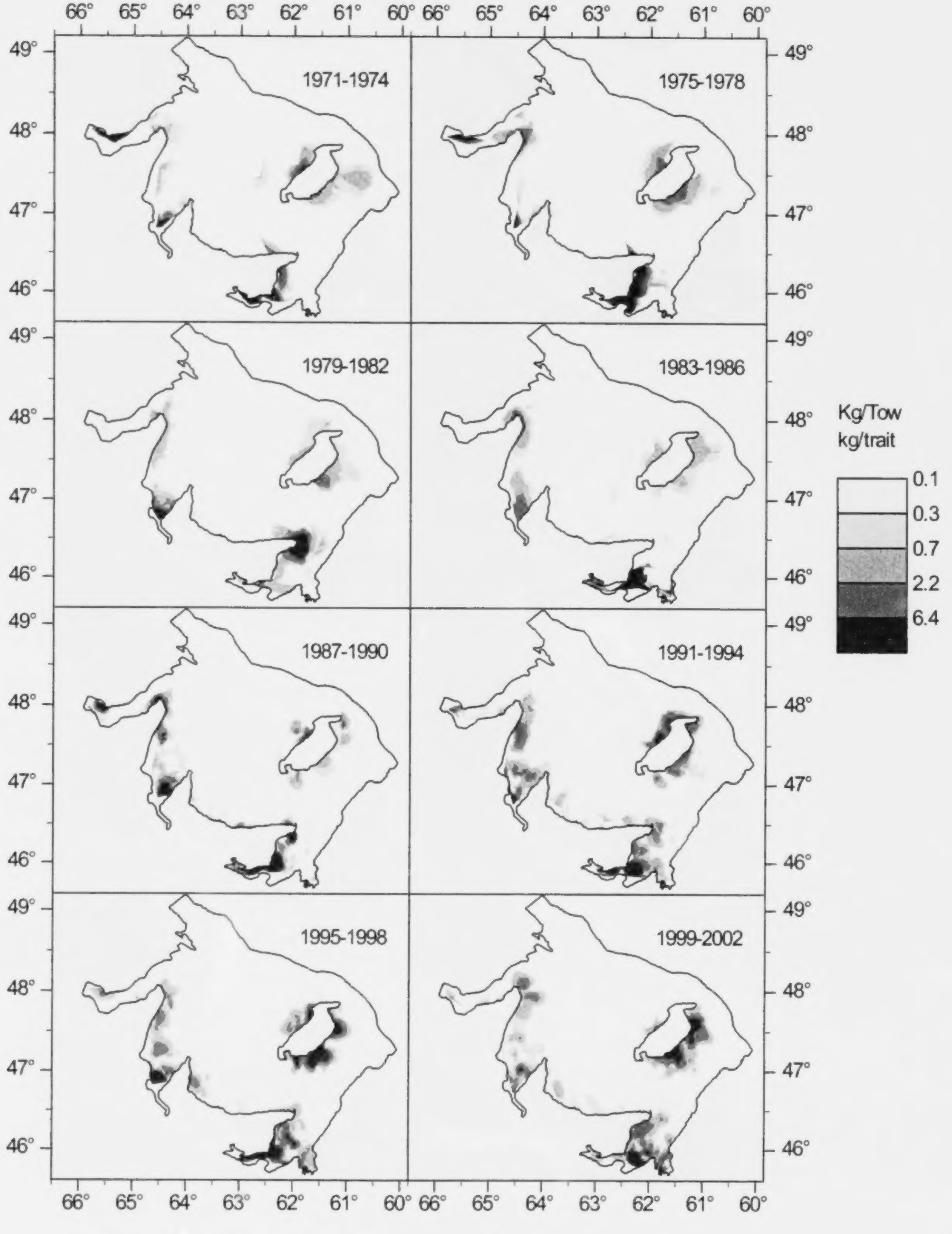

Figure 52a. September distribution of catches (kg) of Longhorn Sculpin,
Myoxocephalus octodecemspinosus

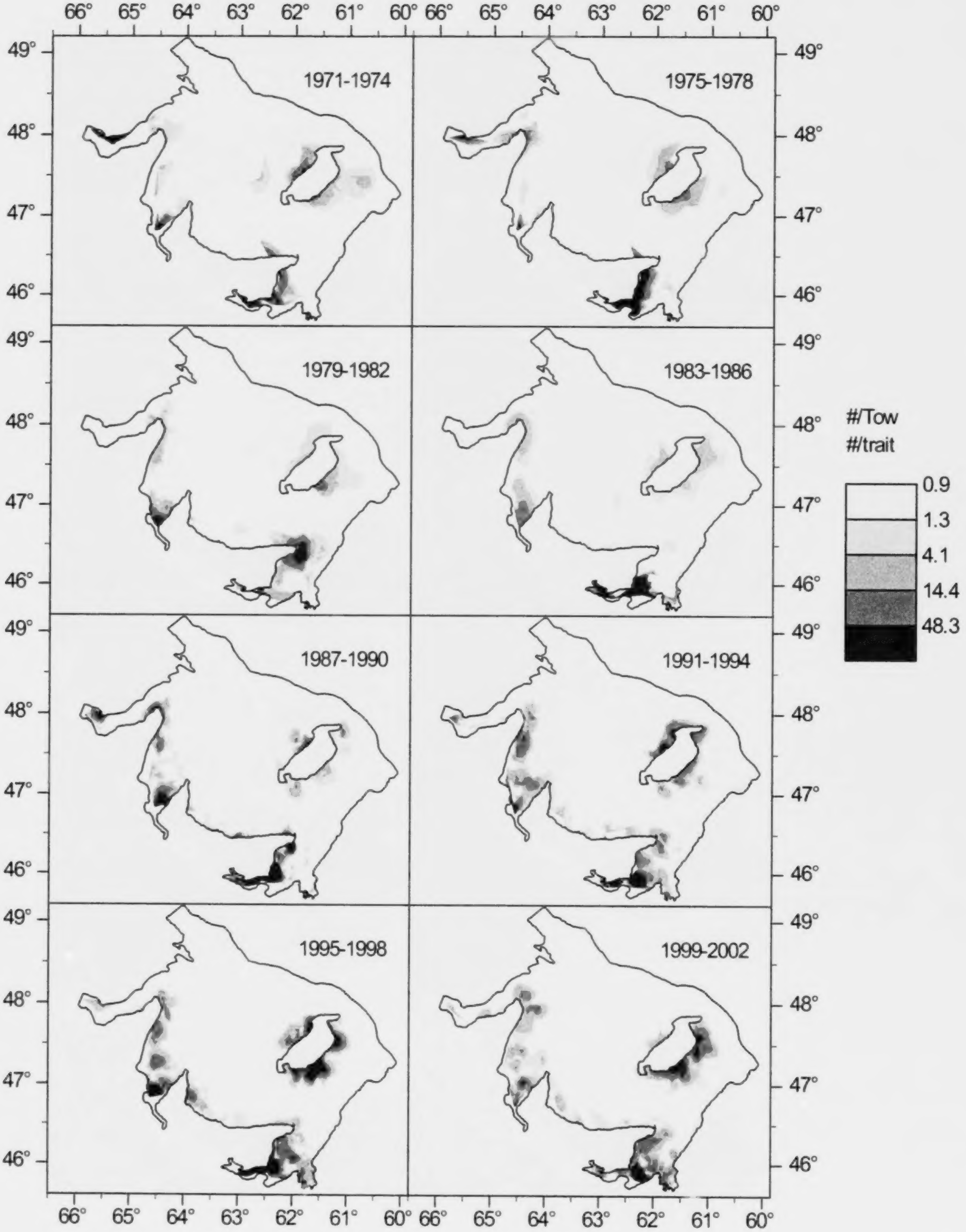

Figure 52b. September distribution of catches (#) of Longhorn Sculpin, *Myoxocephalus octodecemspinosus*

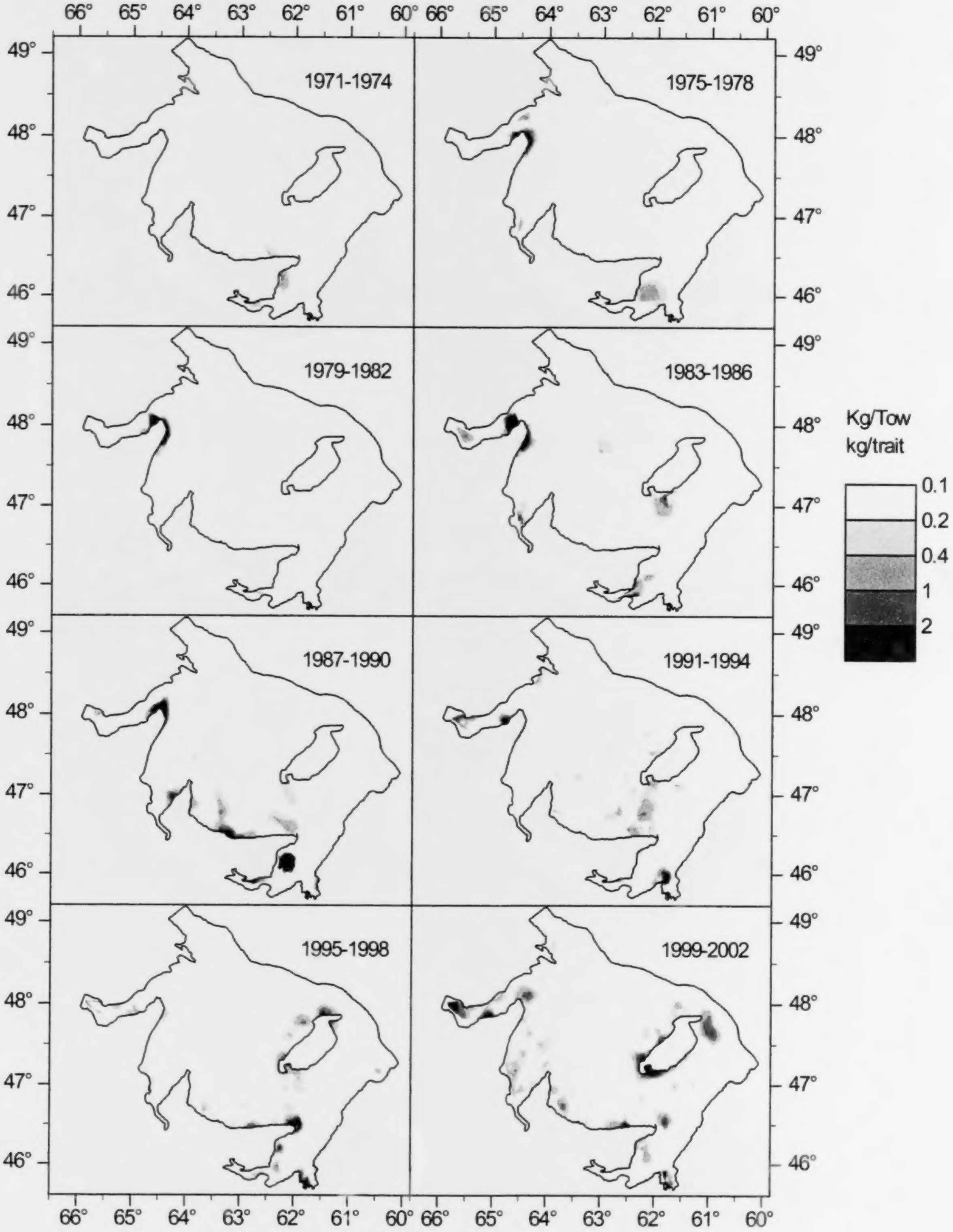

Figure 53a. September distribution of catches (kg) of Shorthorn Sculpin, *Myoxocephalus scorpius*

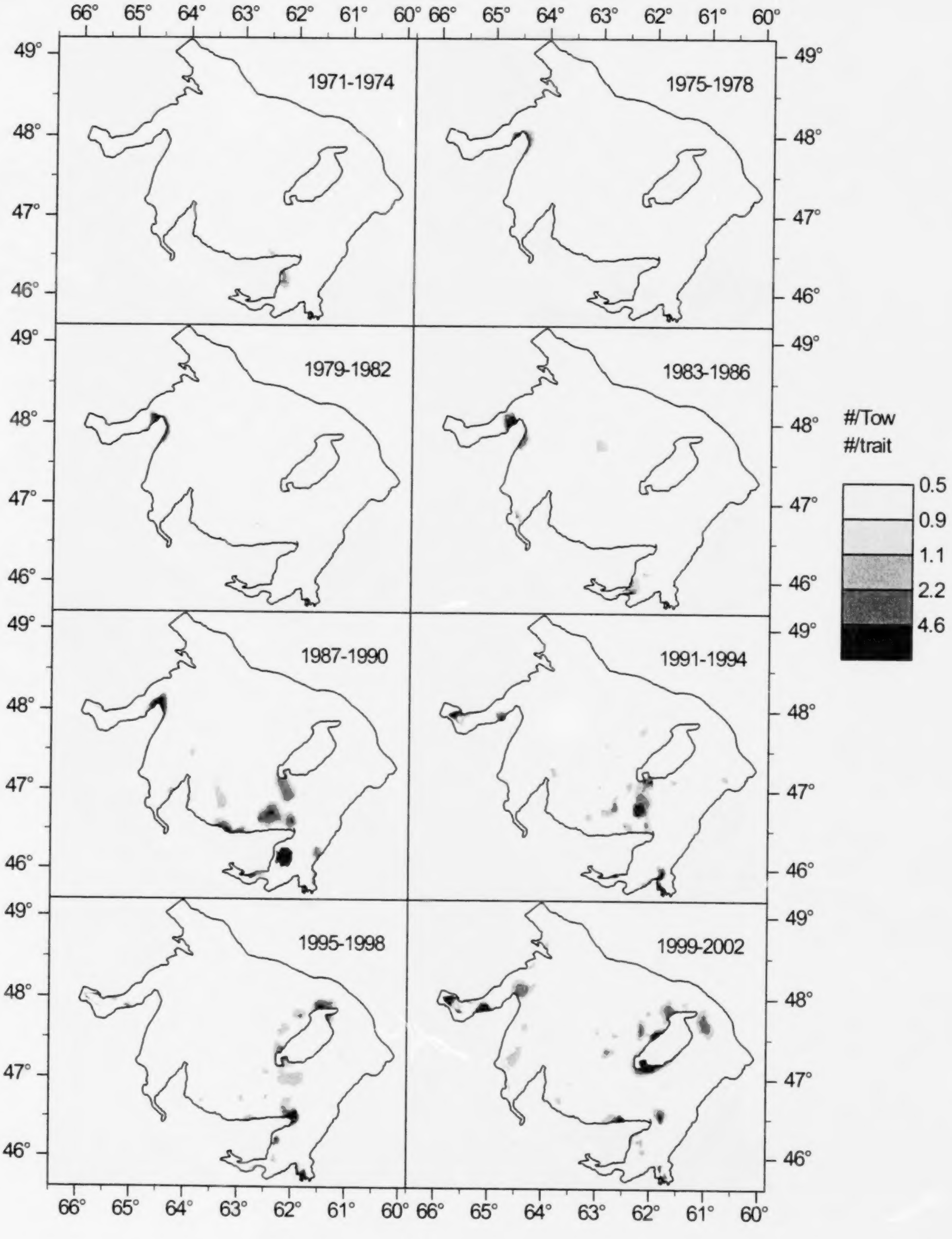

Figure 53b. September distribution of catches (#) of Shorthorn Sculpin, *Myoxocephalus scorpius*

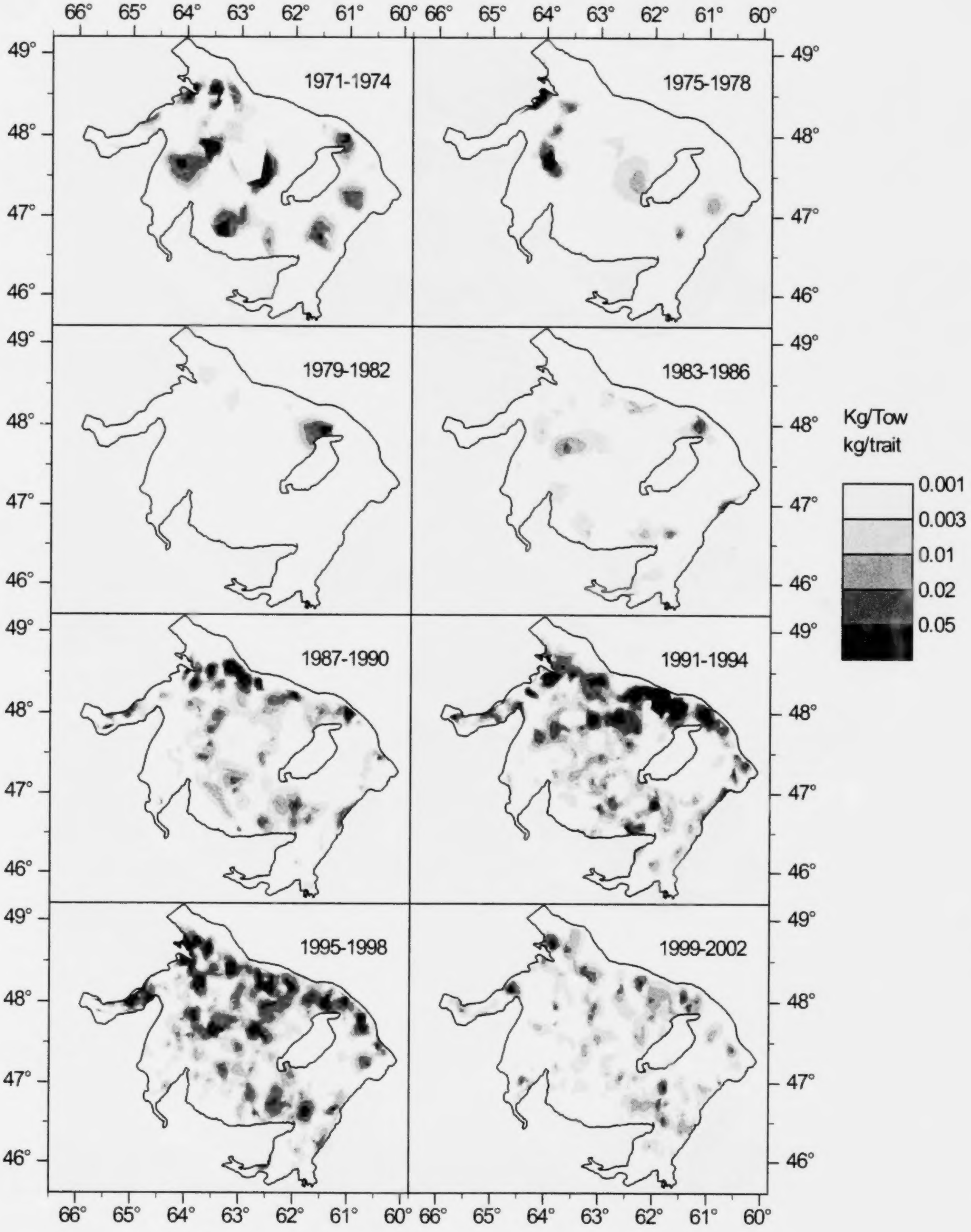

Figure 54a. September distribution of catches (kg) of Mailed Sculpin, *Triglops murrayi*

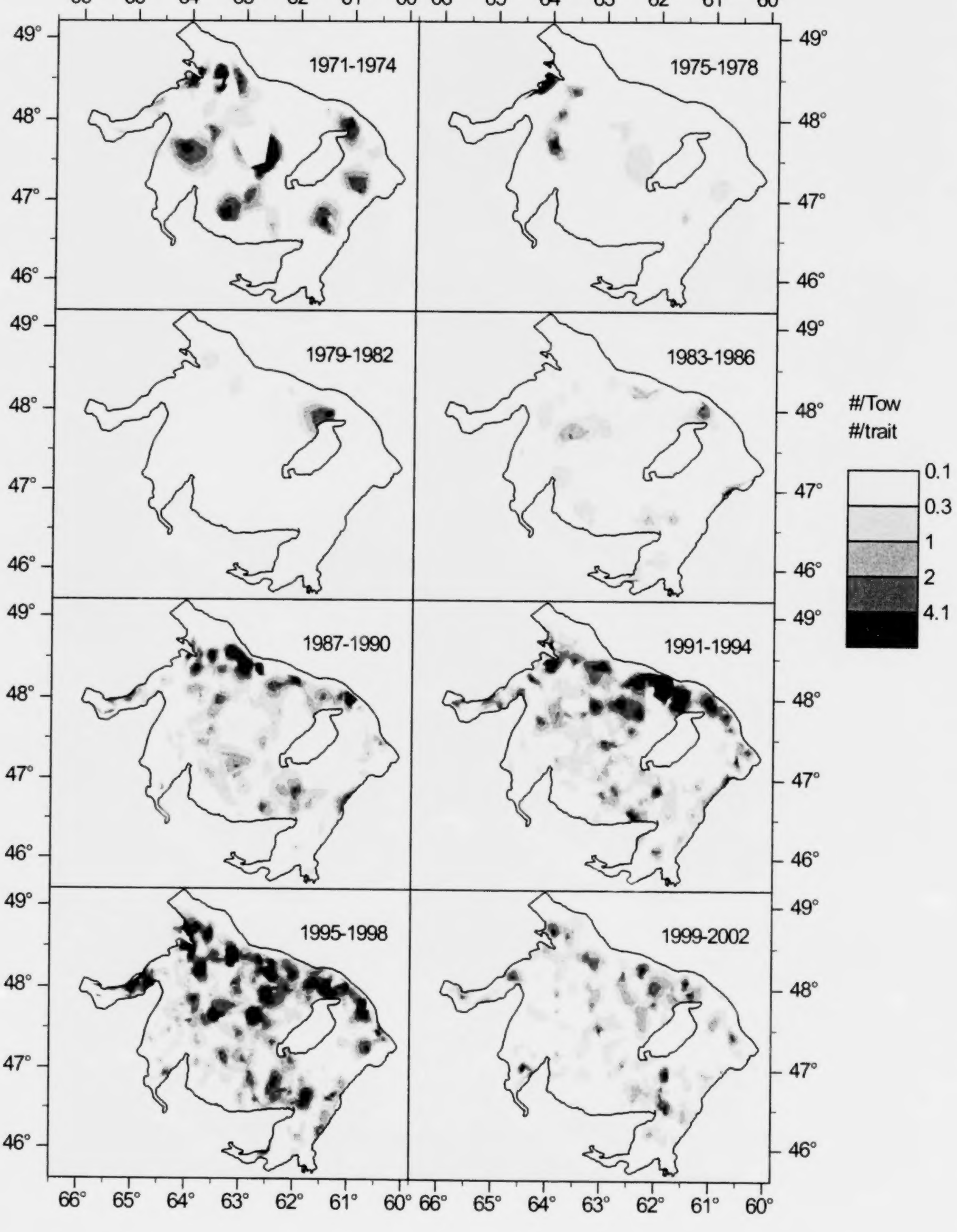

Figure 54b. September distribution of catches (#) of Mailed Sculpin, *Triglops murrayi*

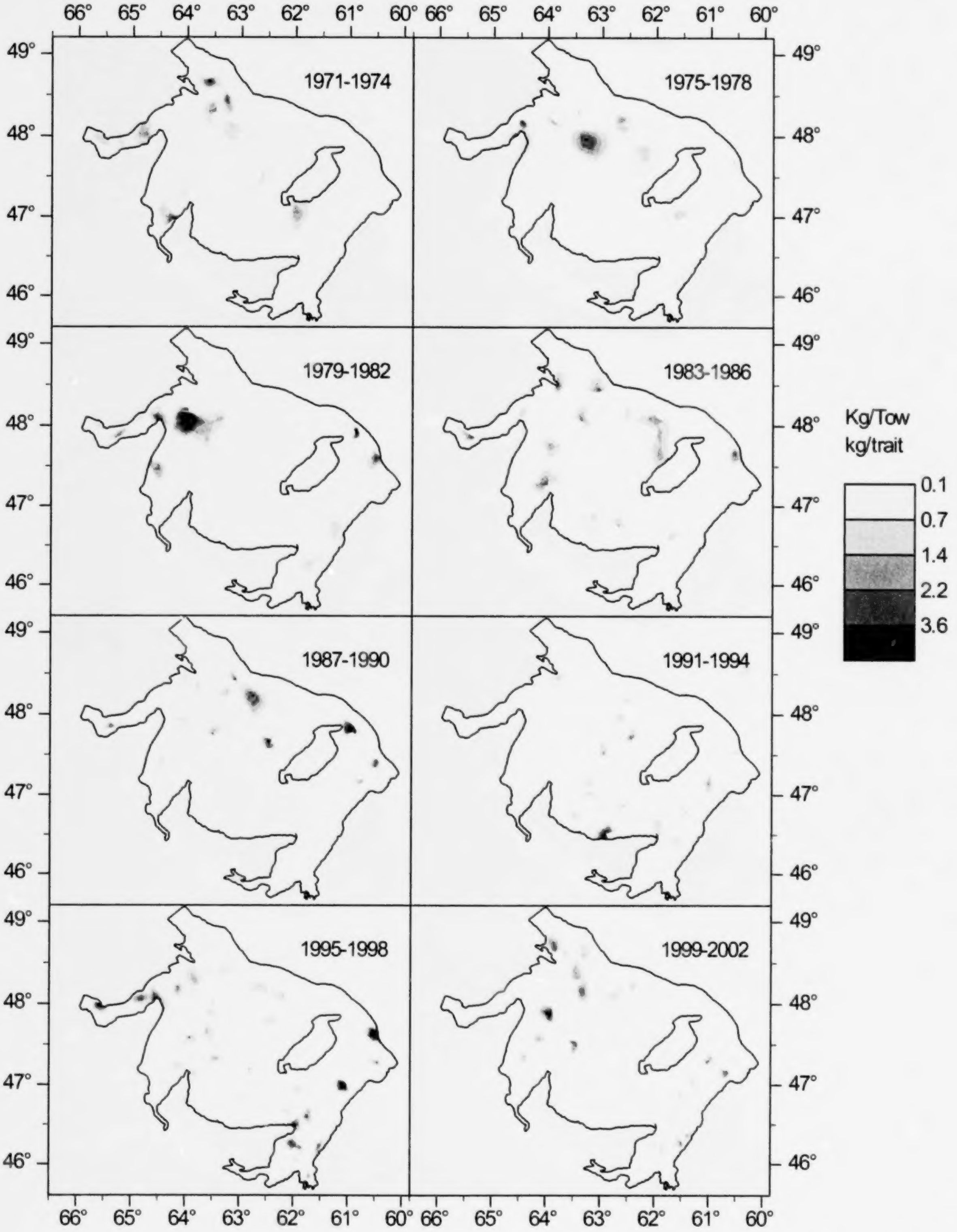

Figure 55a. September distribution of catches (kg) of Lumpfish, *Cyclopterus lumpus*

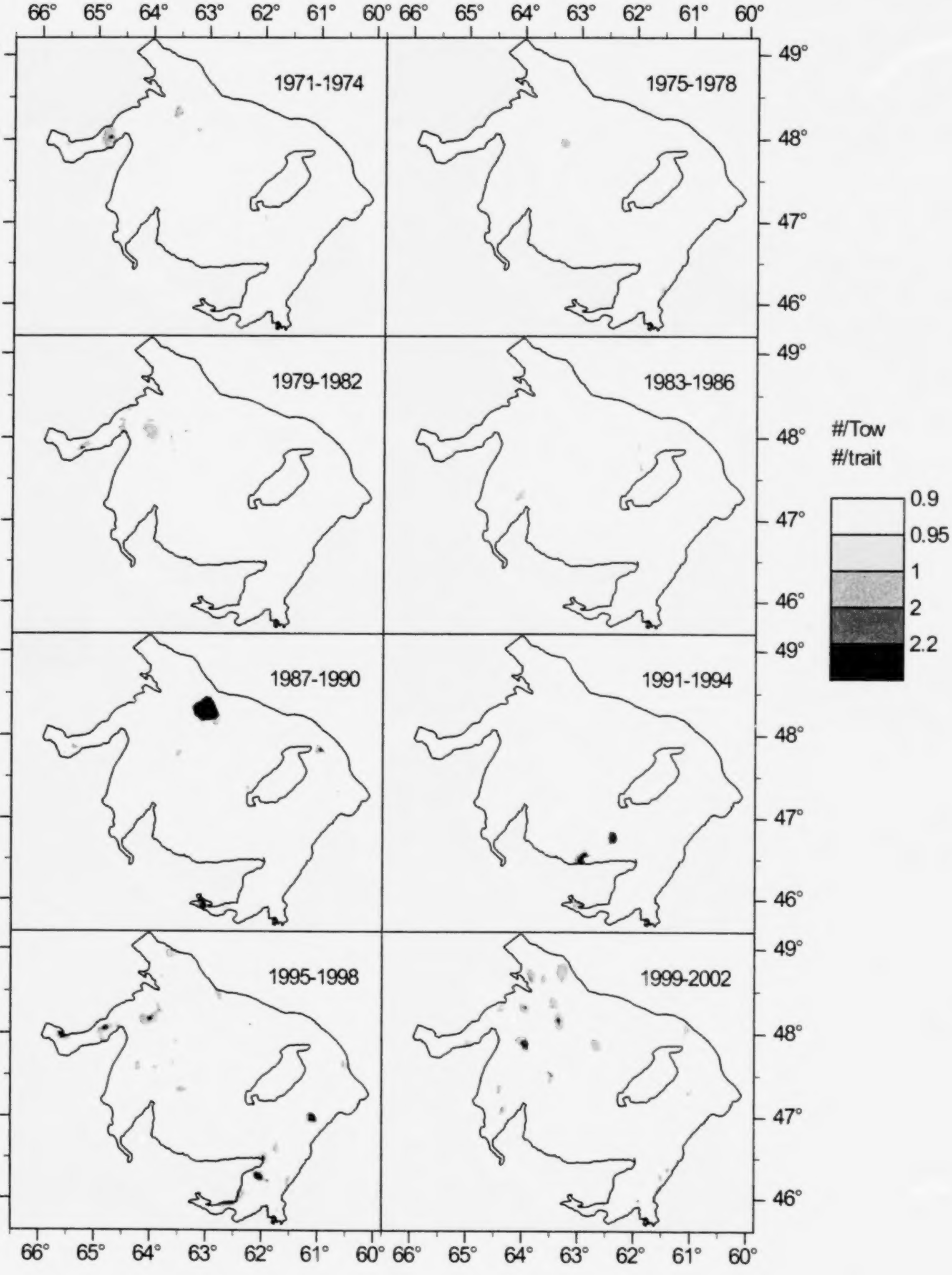

Figure 55b. September distribution of catches (#) of Lumpfish, *Cyclopterus lumpus*

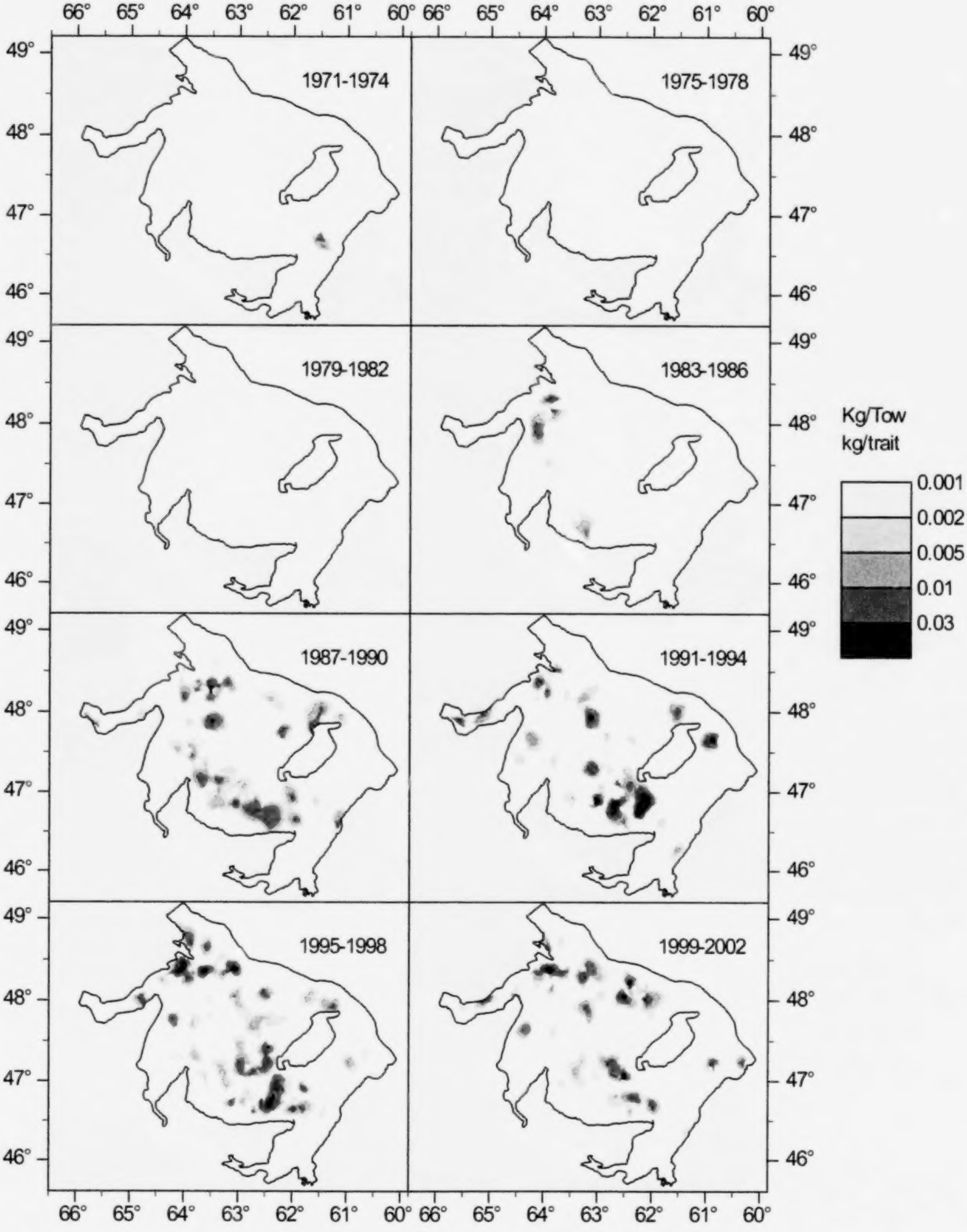

Figure 56a. September distribution of catches (kg) of Atlantic Spiny Lumpsucker, *Eumicrotremus spinosus*

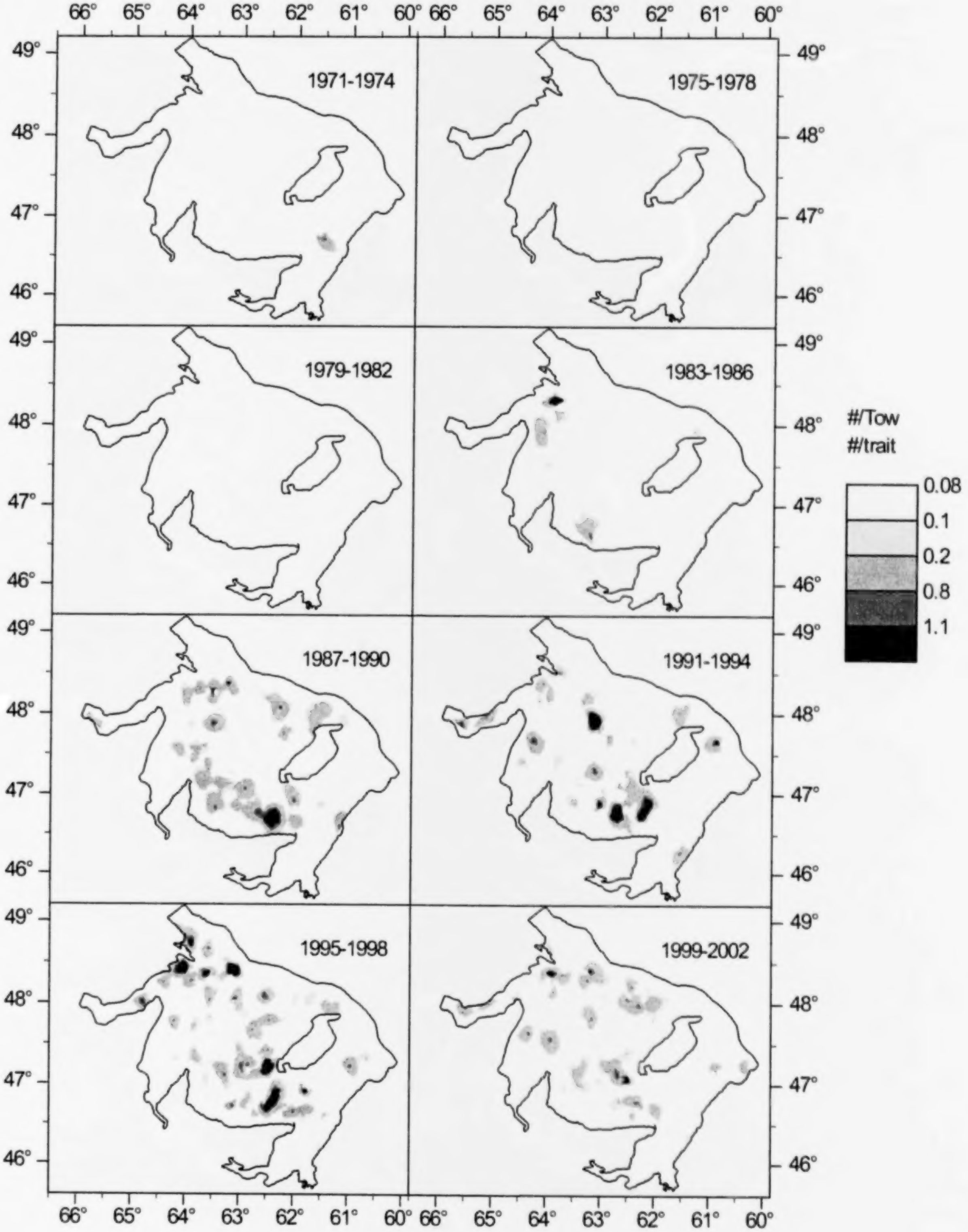

Figure 56b. September distribution of catches (#) of Atlantic Spiny Lumpsucker, *Eumicrotremus spinosus*

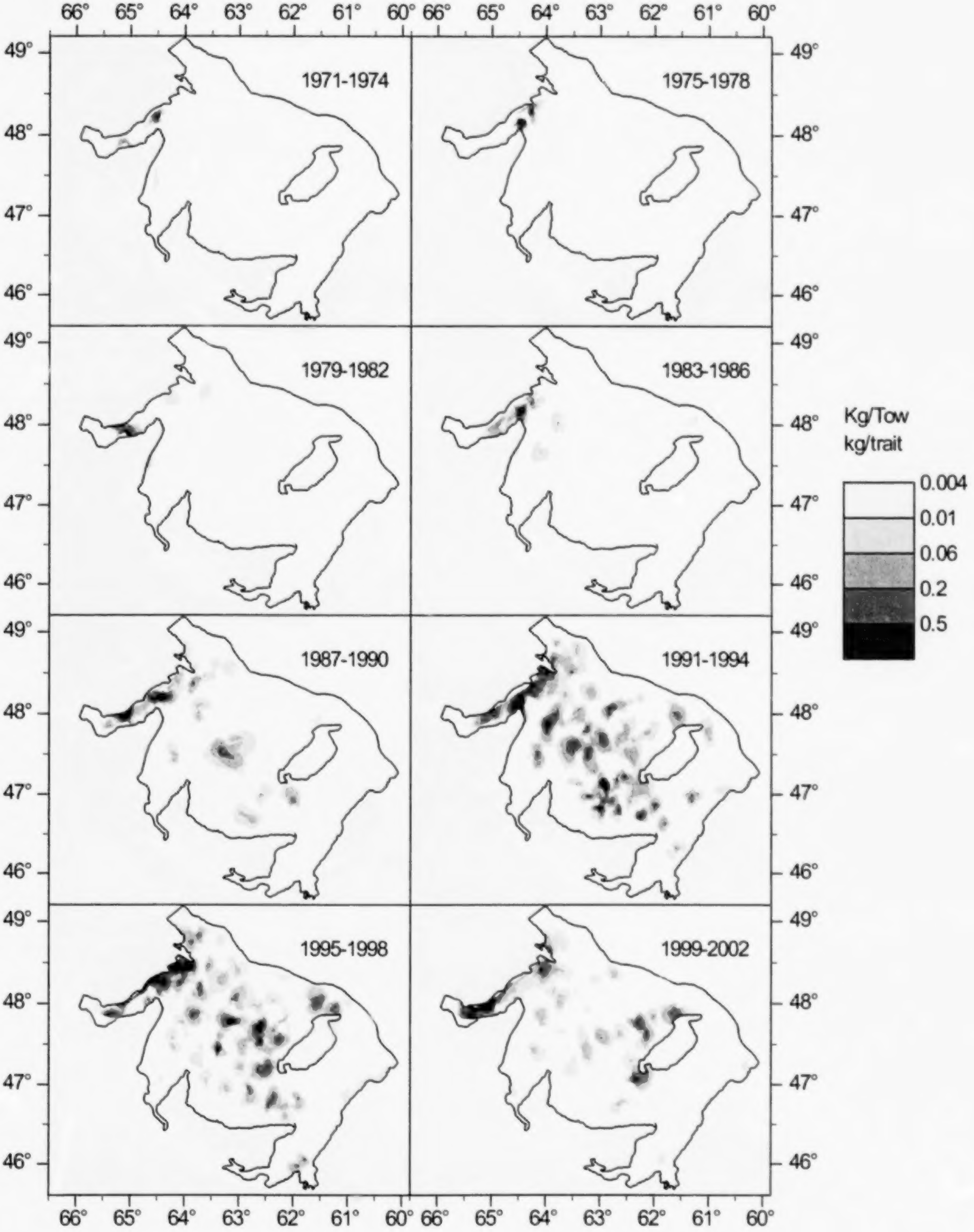

Figure 57a. September distribution of catches (kg) of Unidentified Seasnail, *Liparis sp.*

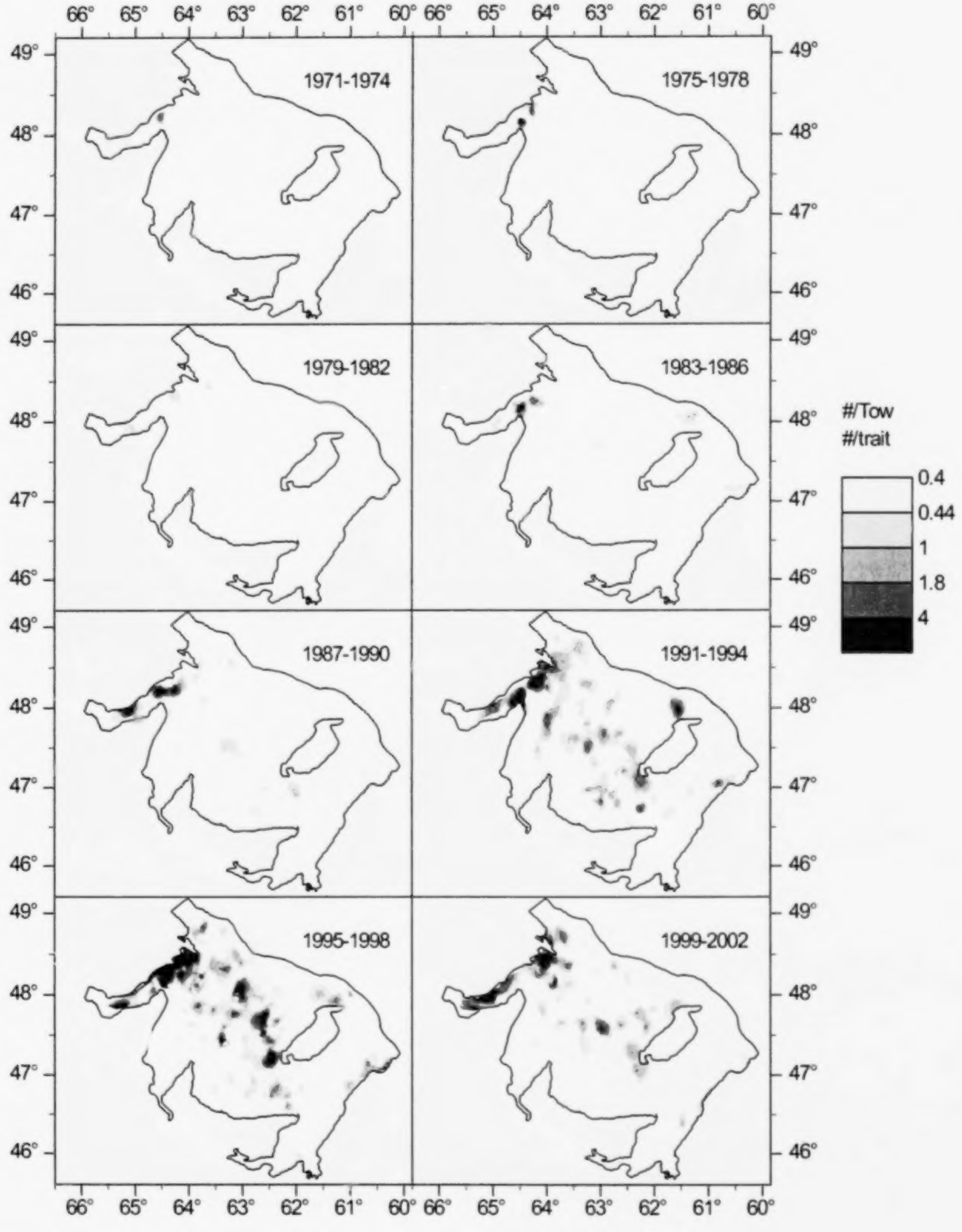

Figure 57b. September distribution of catches (#) of Unidentified Seasnail, *Liparis sp.*

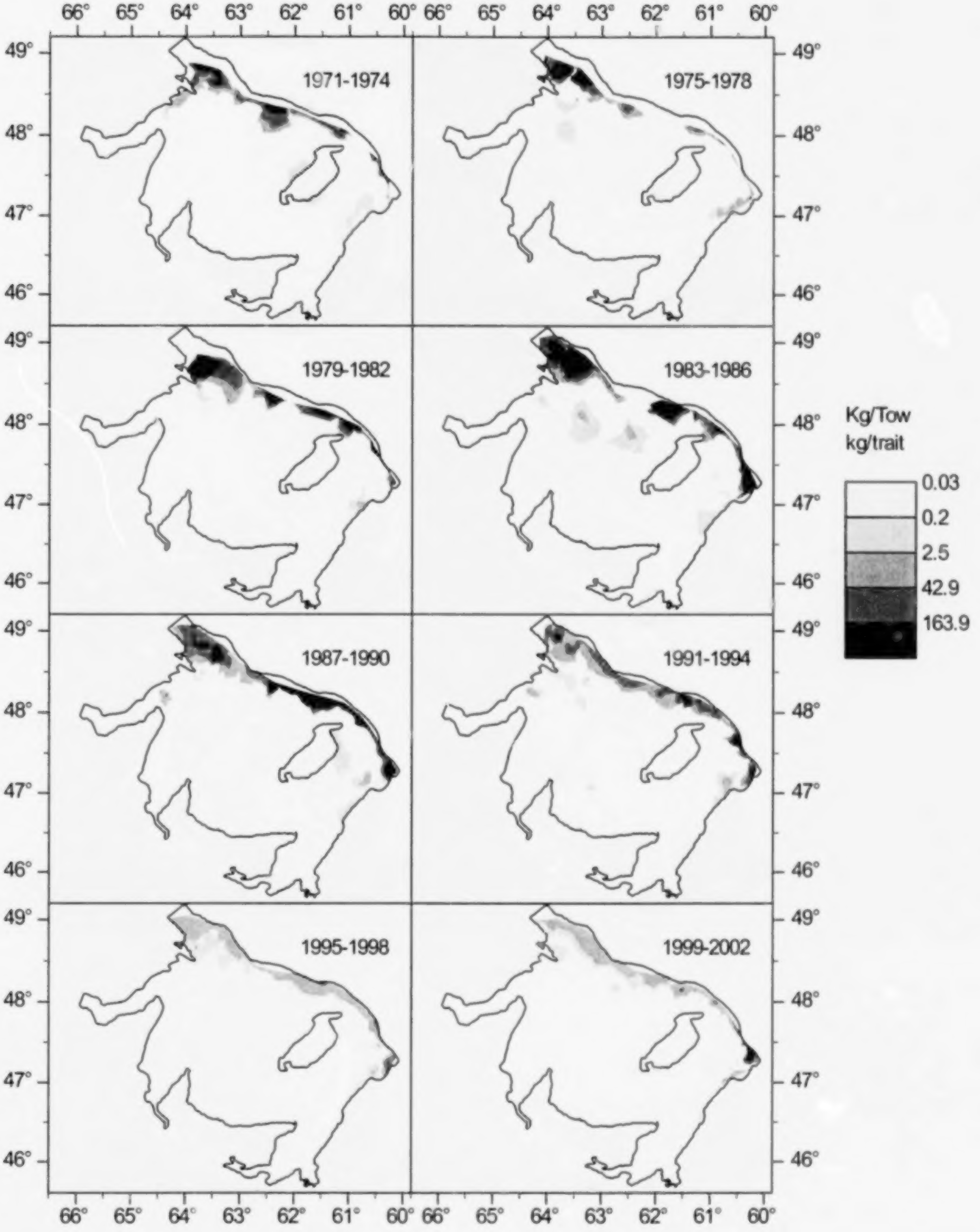

Figure 58a. September distribution of catches (kg) of Unseparated Redfish, *Sebastes sp.*

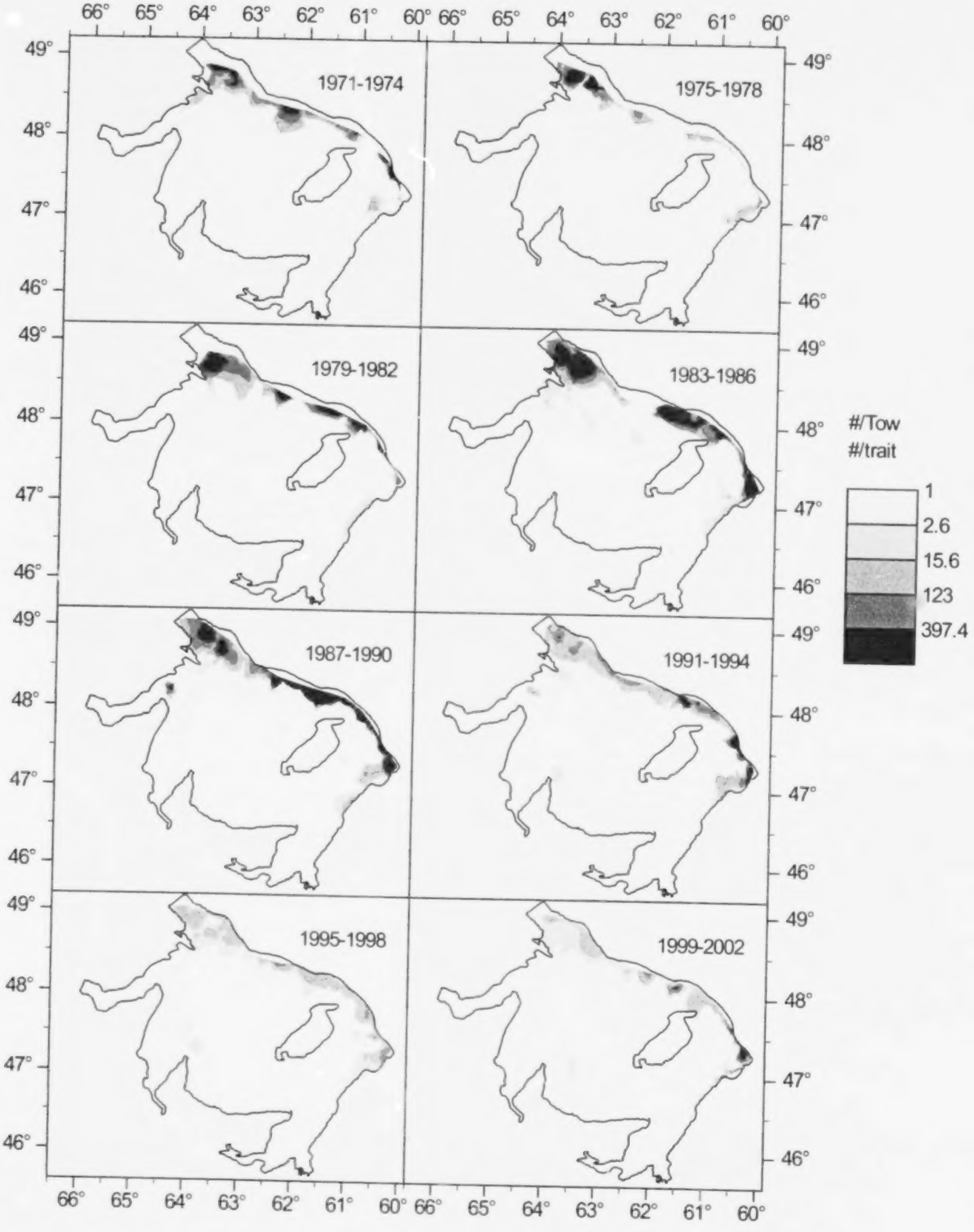

Figure 58b. September distribution of catches (#) of Unseparated Redfish, *Sebastes sp.*

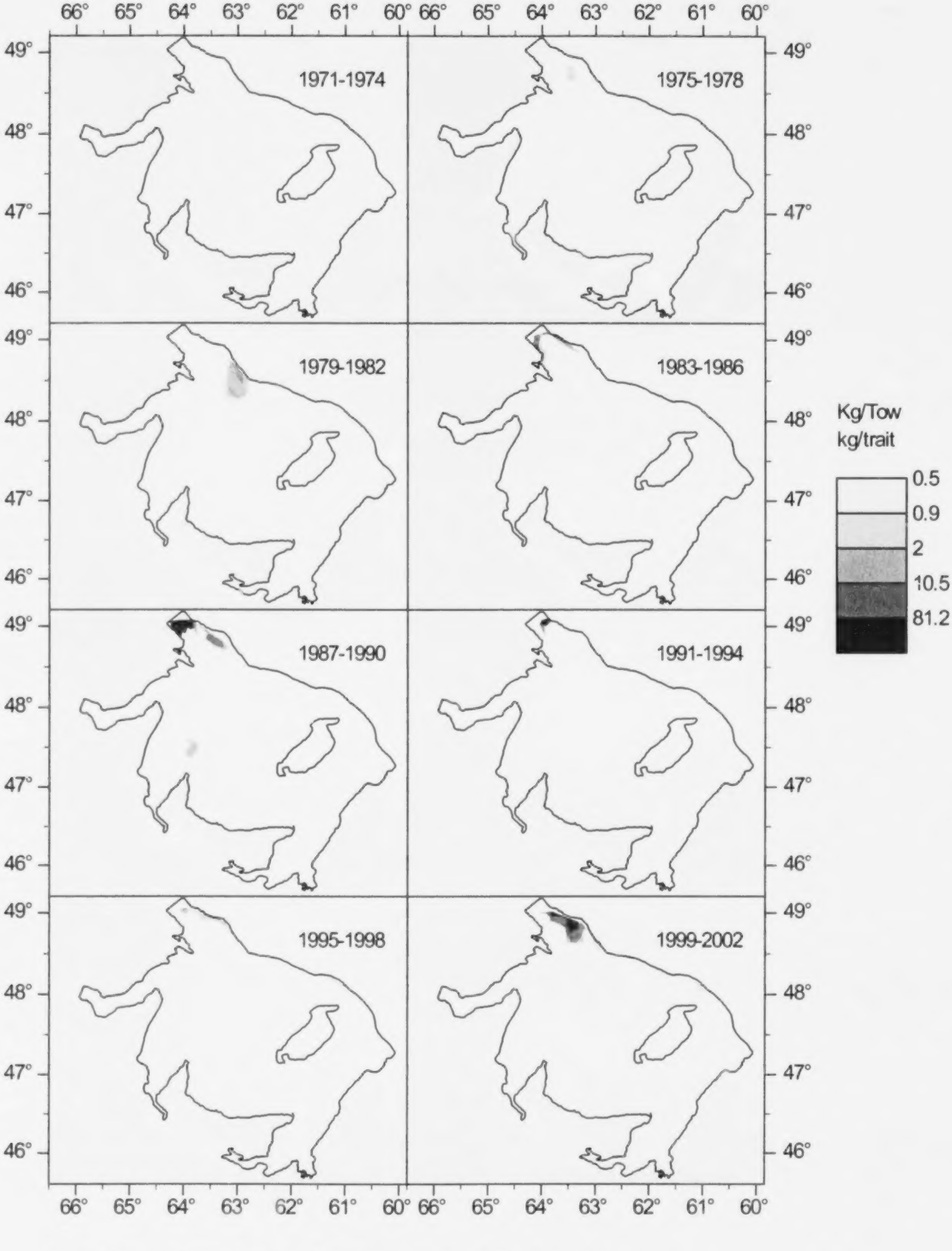

Figure 59a. September distribution of catches (kg) of Black Dogfish, *Centroscyllium fabricii*

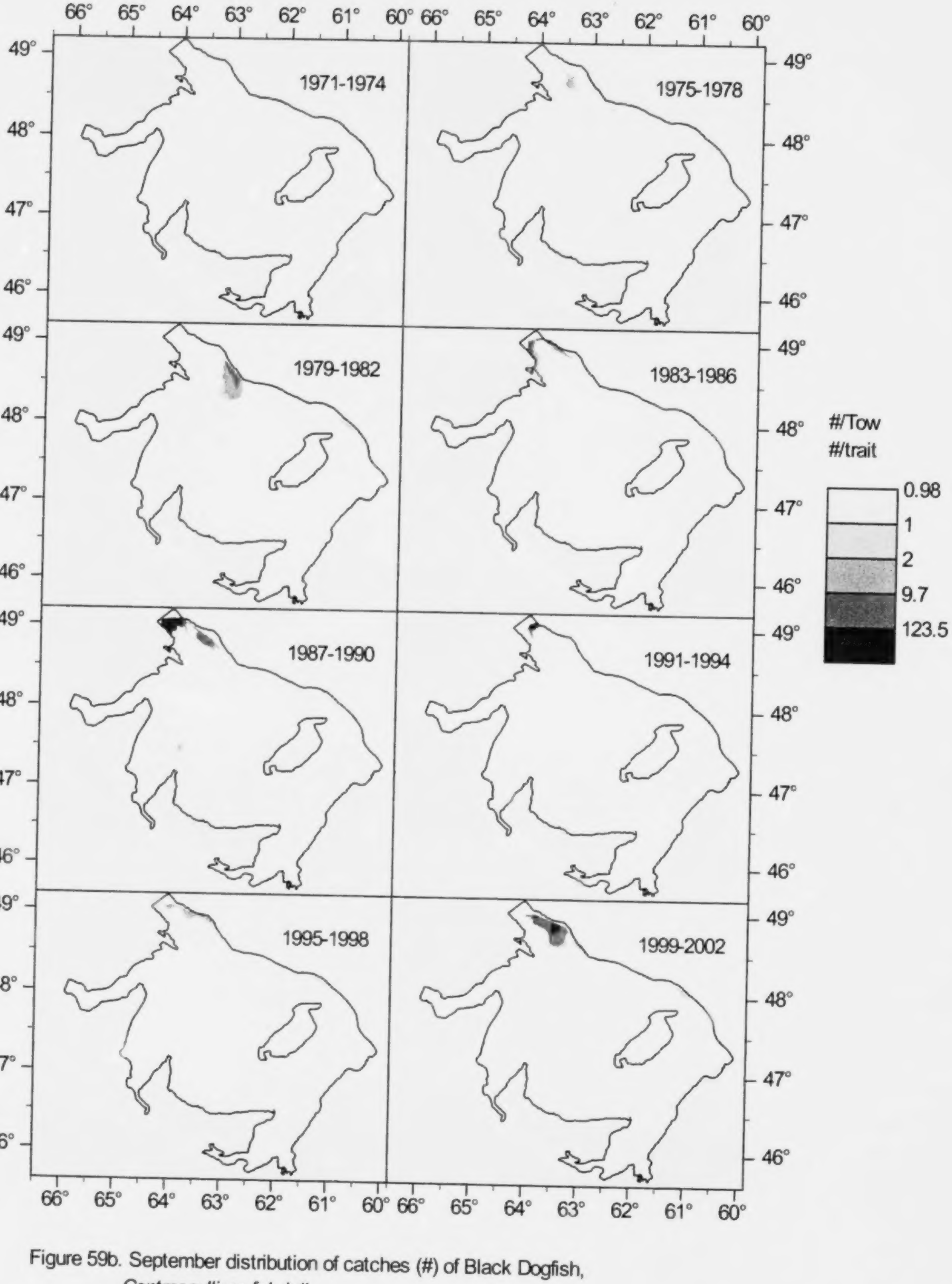

Figure 59b. September distribution of catches (#) of Black Dogfish, *Centroscyllium fabricii*

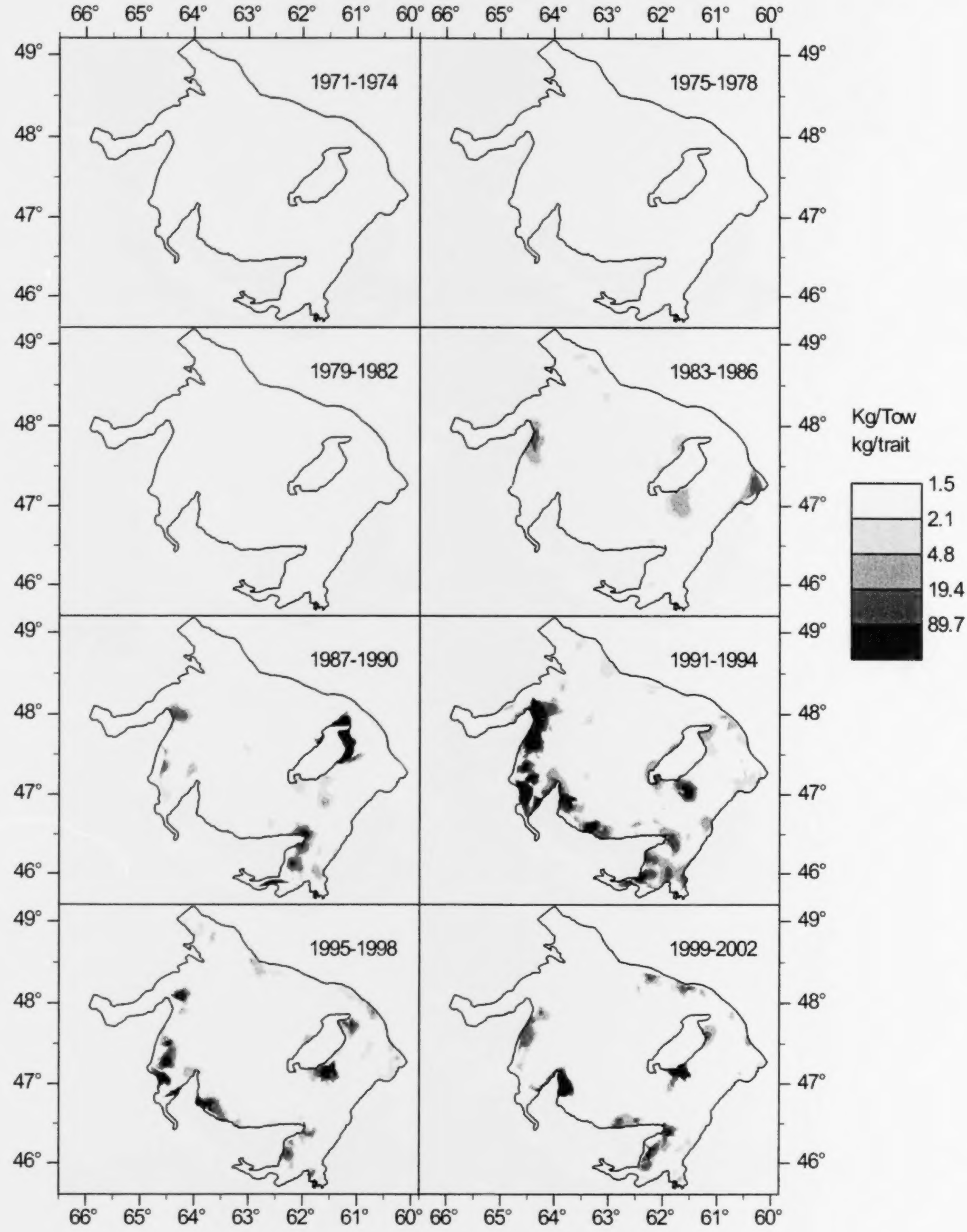

Figure 60a. September distribution of catches (kg) of Spiny Dogfish, *Squalus acanthias*

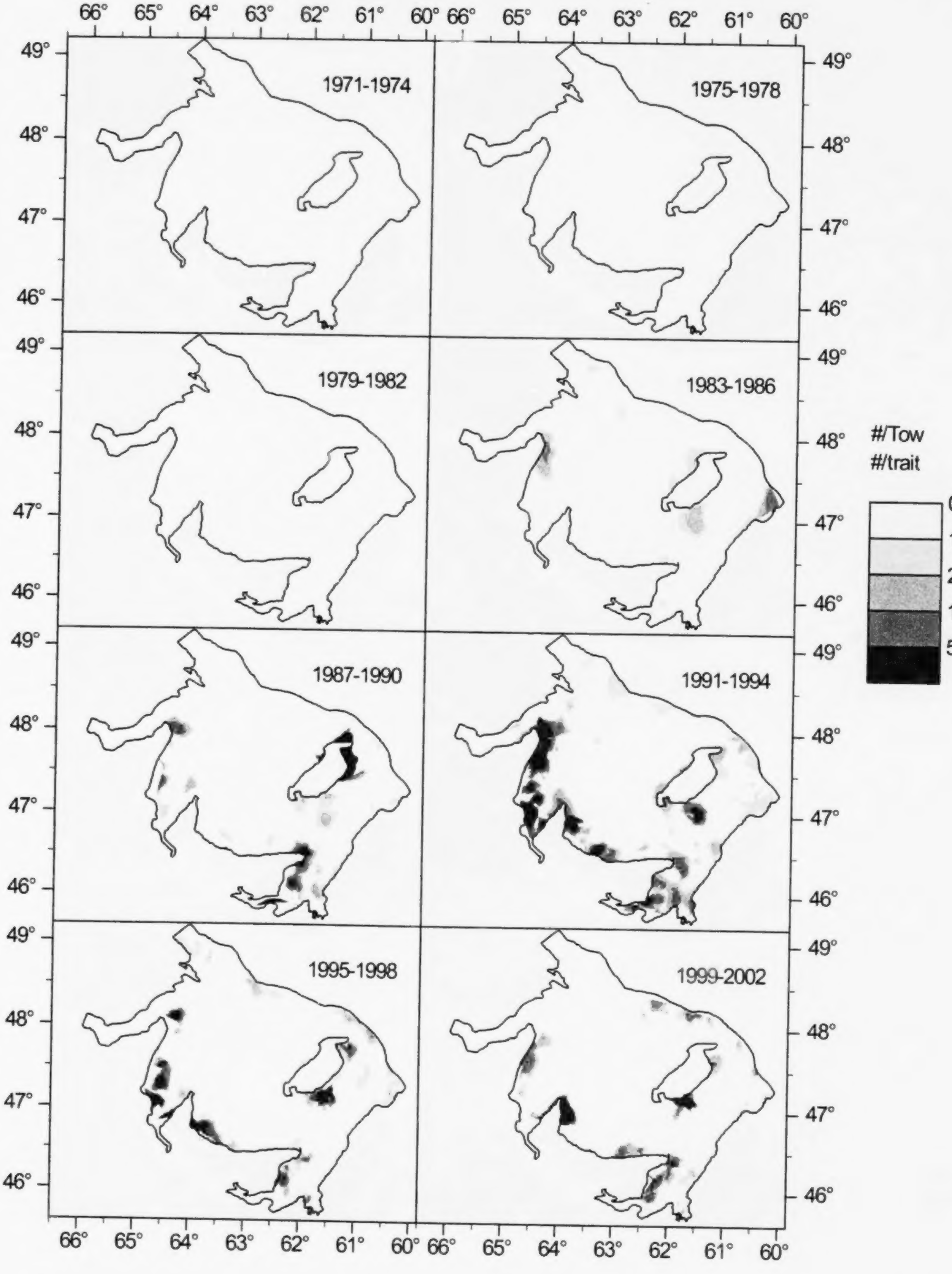

Figure 60b. September distribution of catches (#) of Spiny Dogfish, *Squalus acanthias*

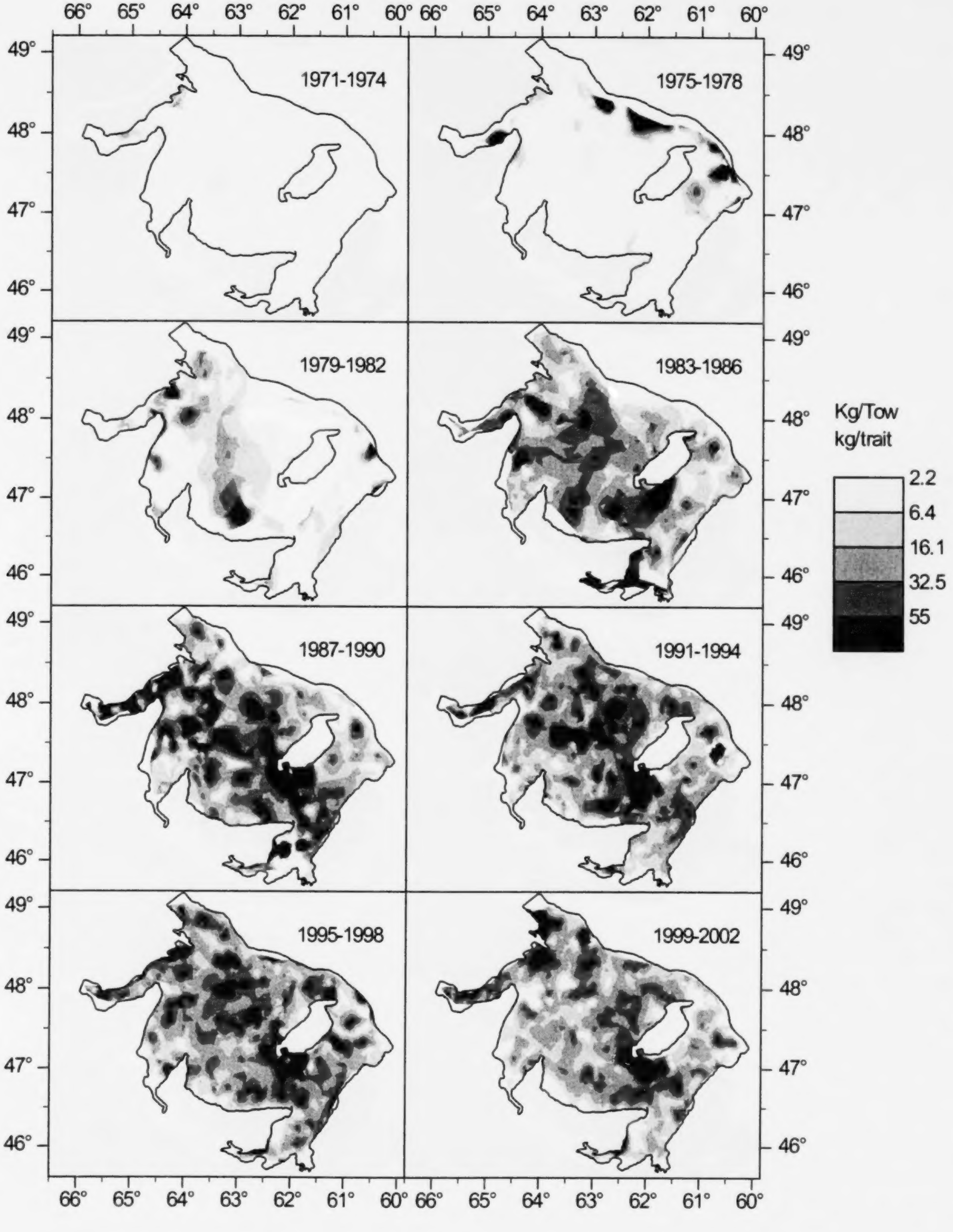

Figure 61. September distribution of catches (kg) of Unspecified Marine Invertebrates, Invertebrata

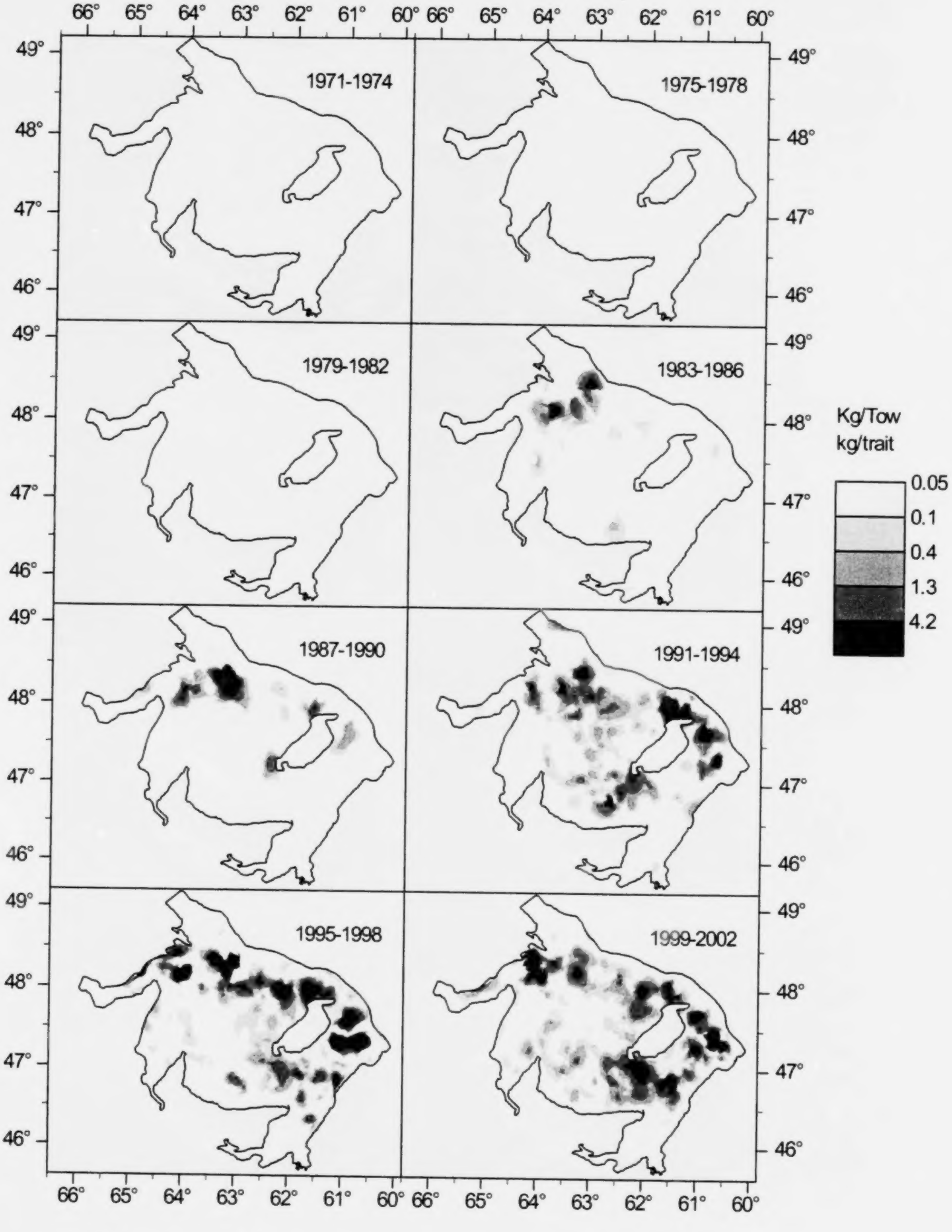

Figure 62. September distribution of catches (kg) of Tunicates, Tunicata

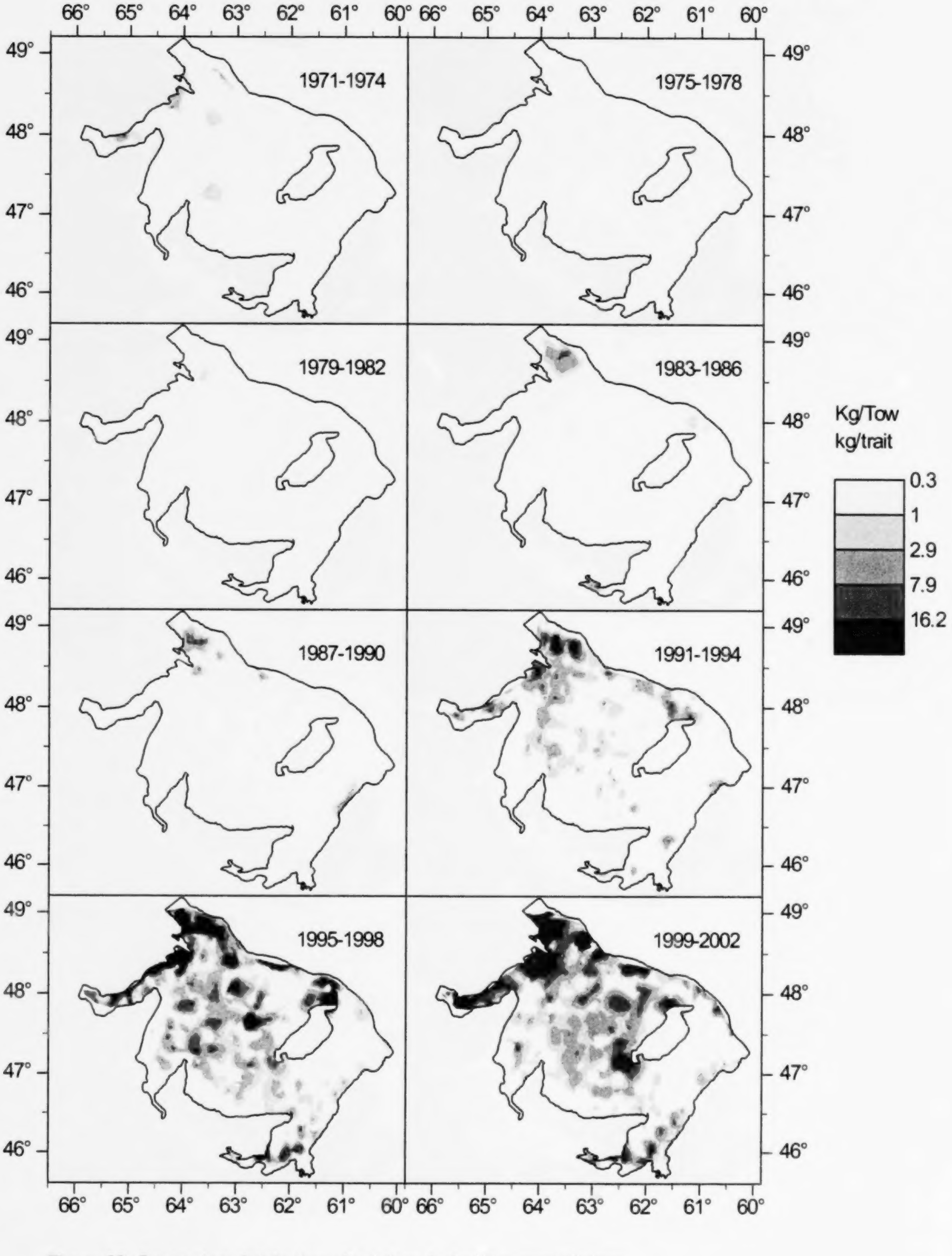

Figure 63. September distribution of catches (kg) of Decapod Shrimp, Decapoda

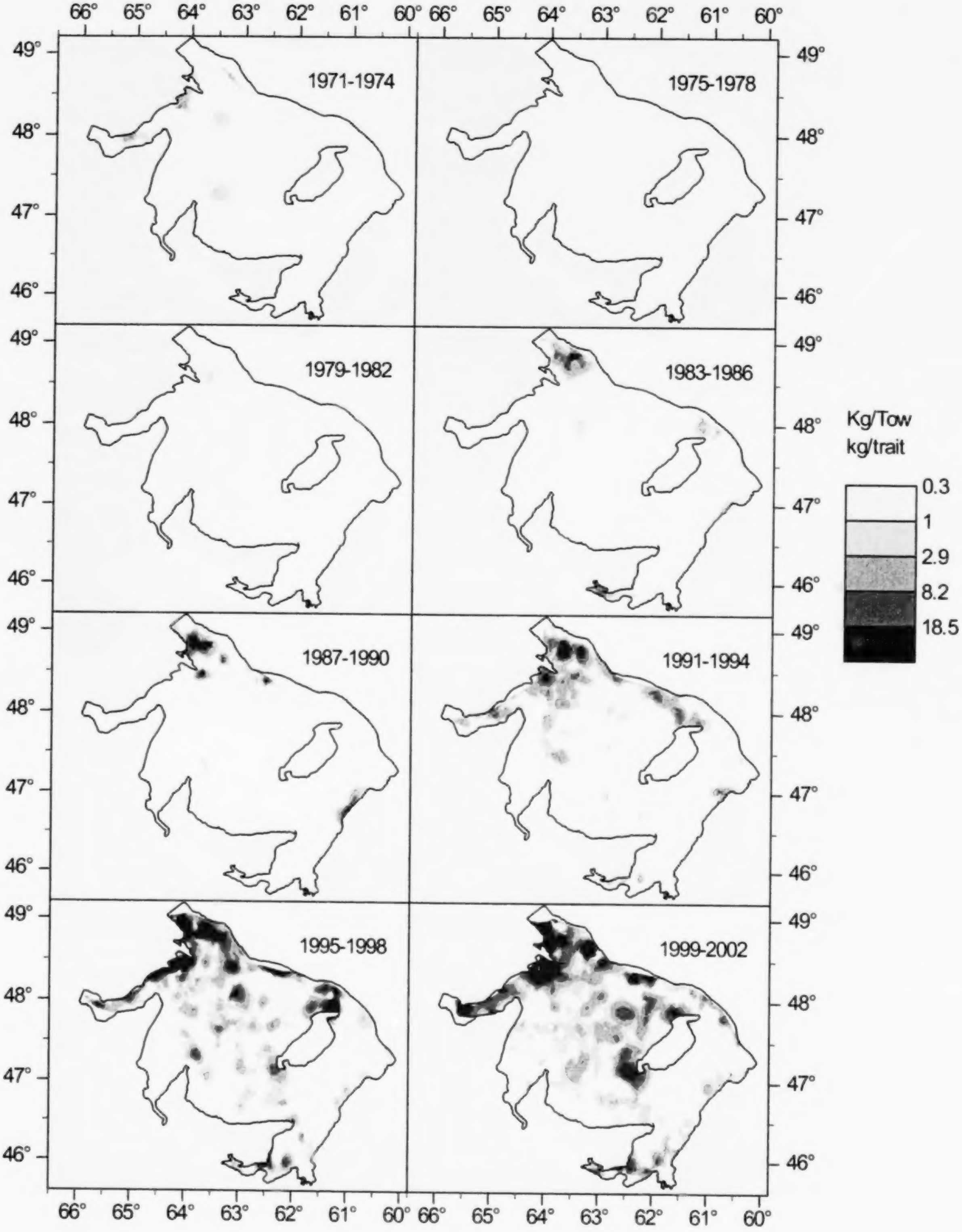

Figure 64. September distribution of catches (kg) of Pandalid Shrimp, Pandalidae

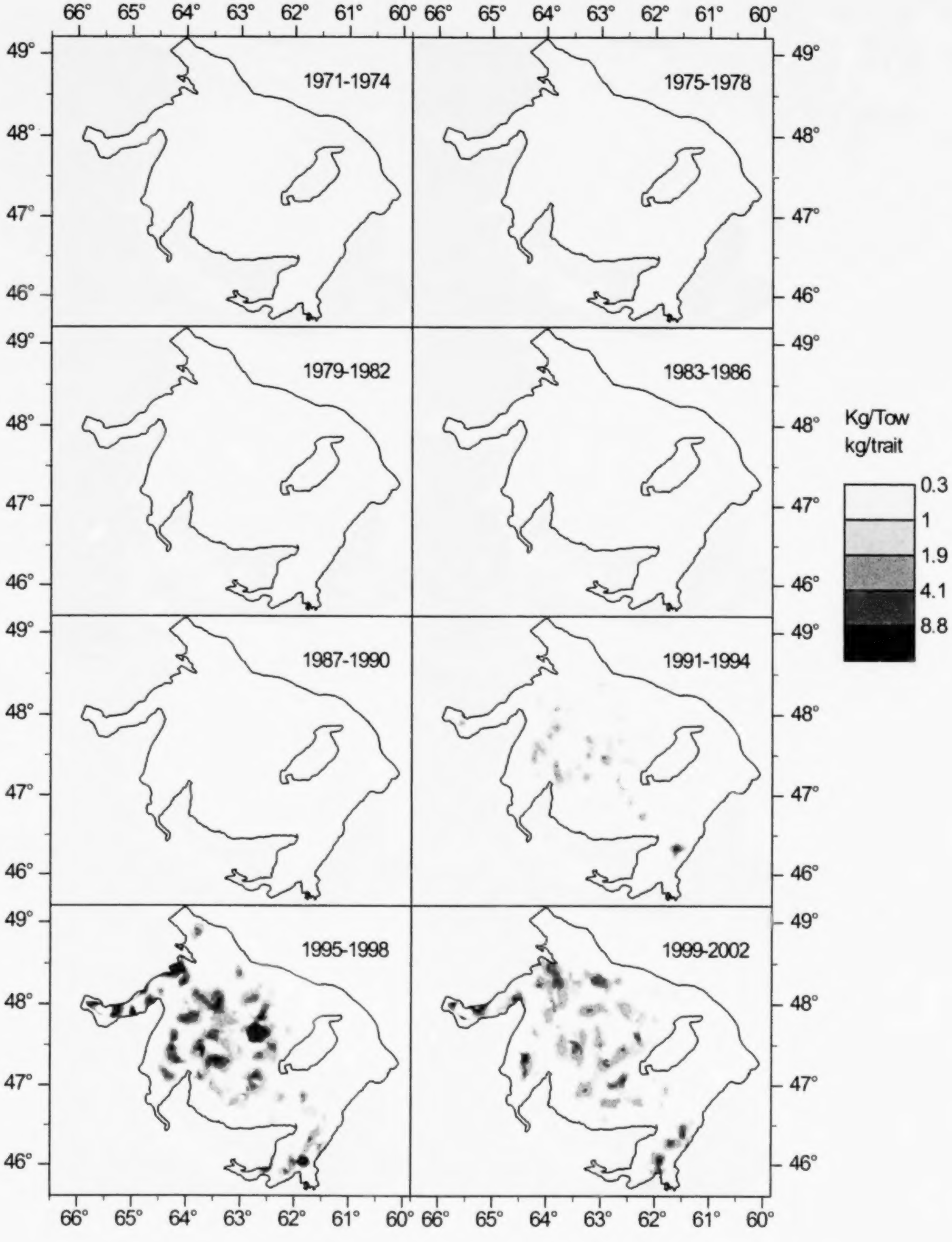

Figure 65. September distribution of catches (kg) of Snapping Shrimp, Crangonidae

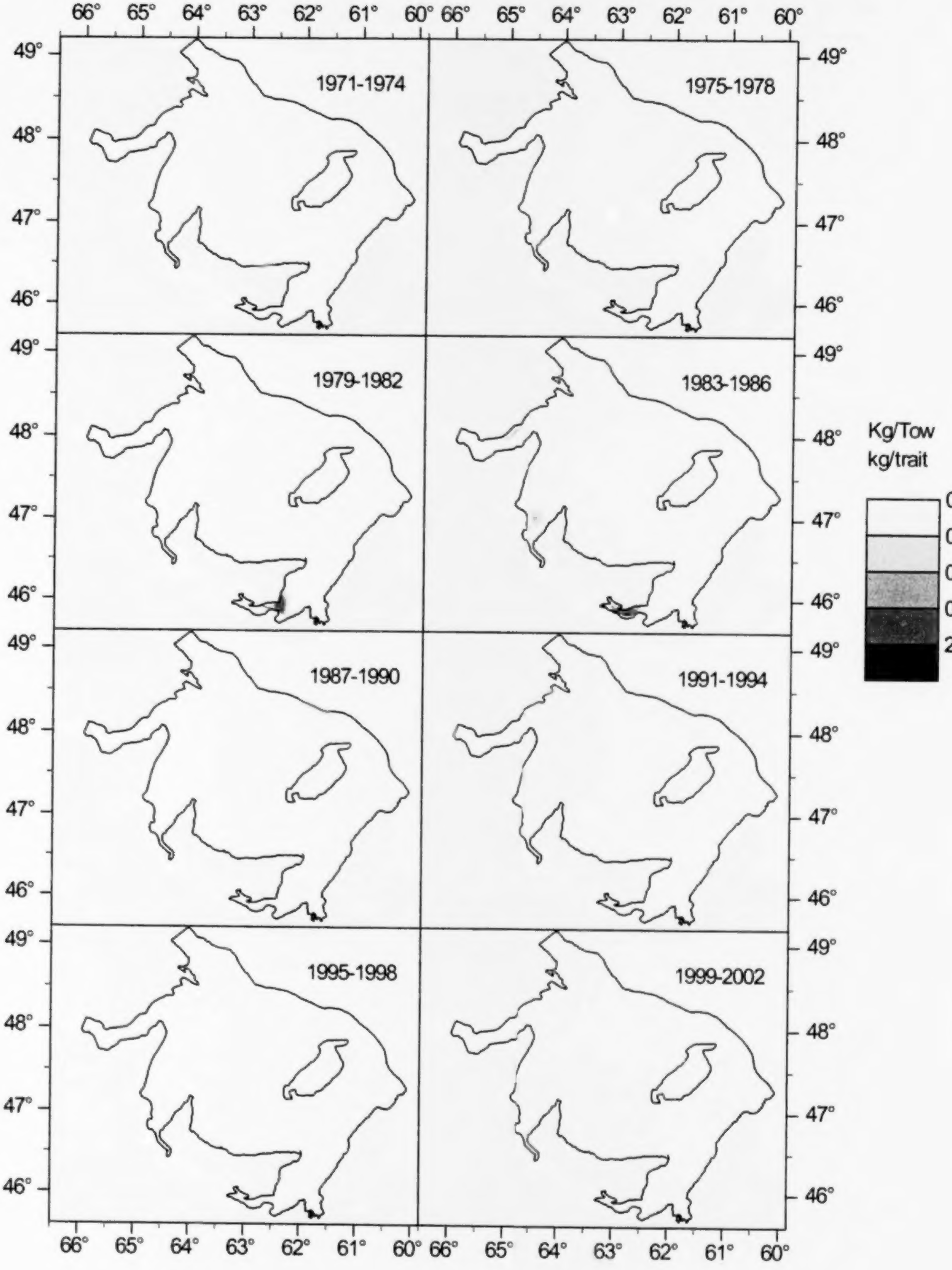

Figure 66. September distribution of catches (kg) of Jonah Crab, *Cancer borealis*

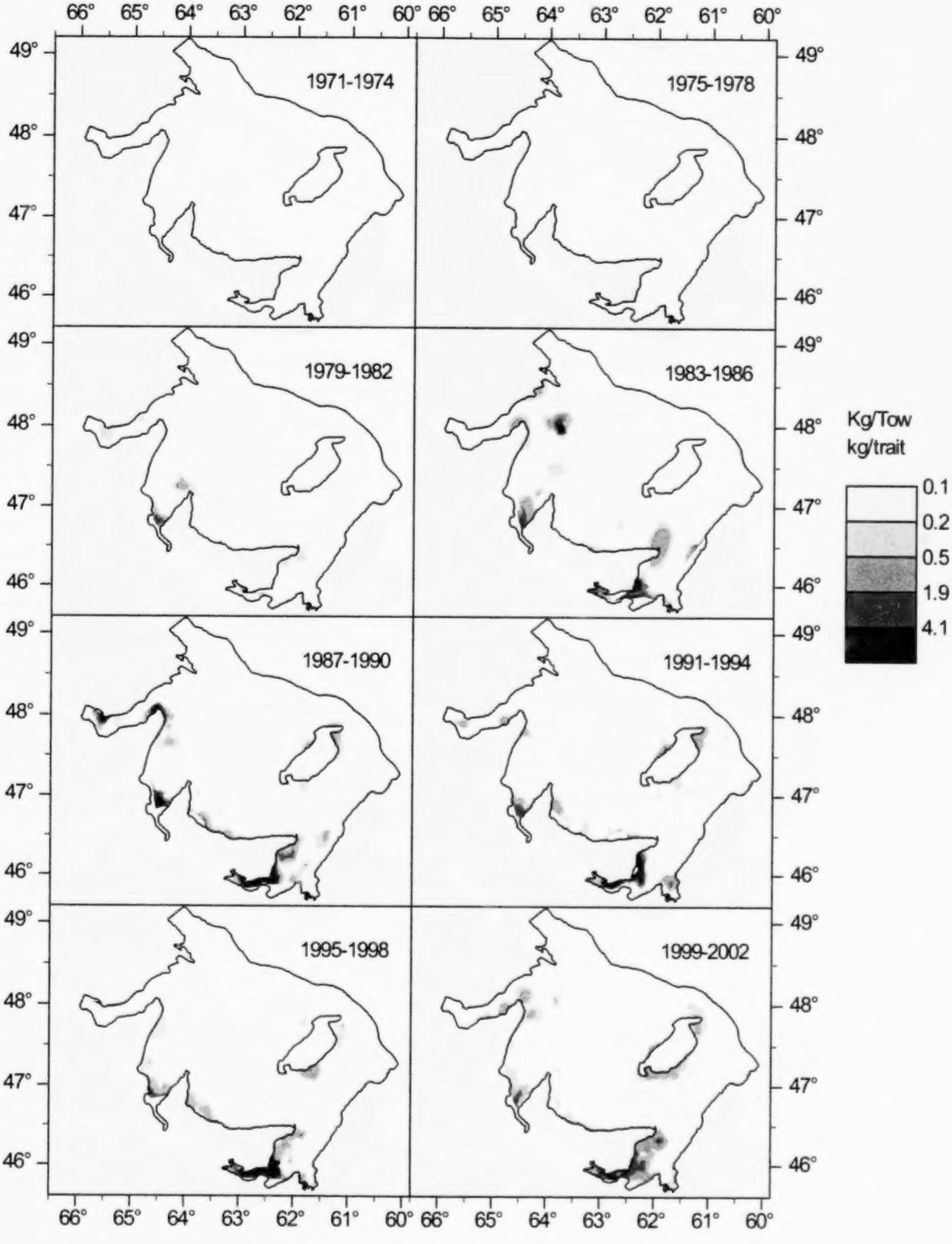

Figure 67. September distribution of catches (kg) of Atlantic Rock Crab, *Cancer irroratus*

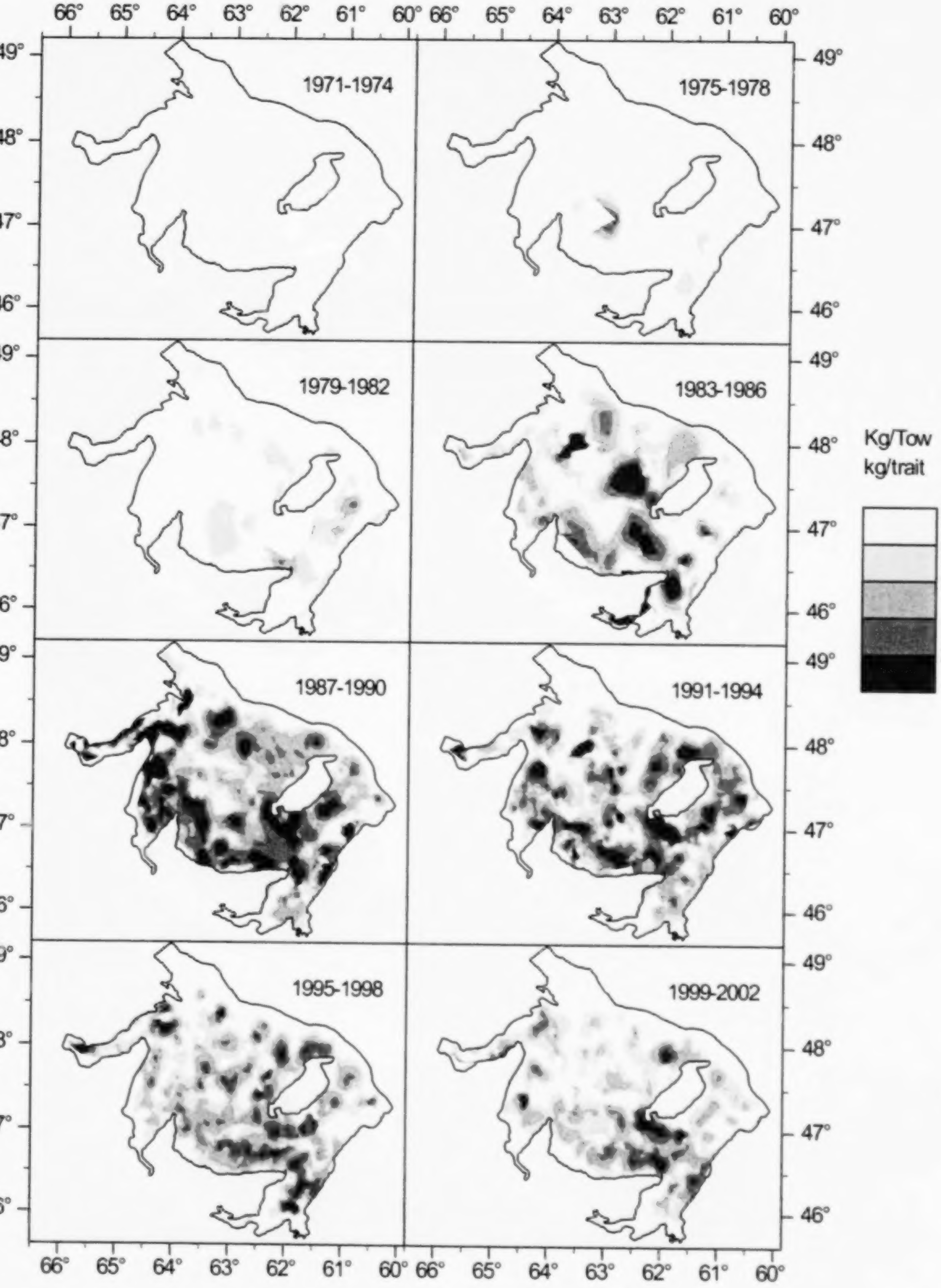

Figure 68. September distribution of catches (kg) of Toad Crabs, *Hyas sp.*

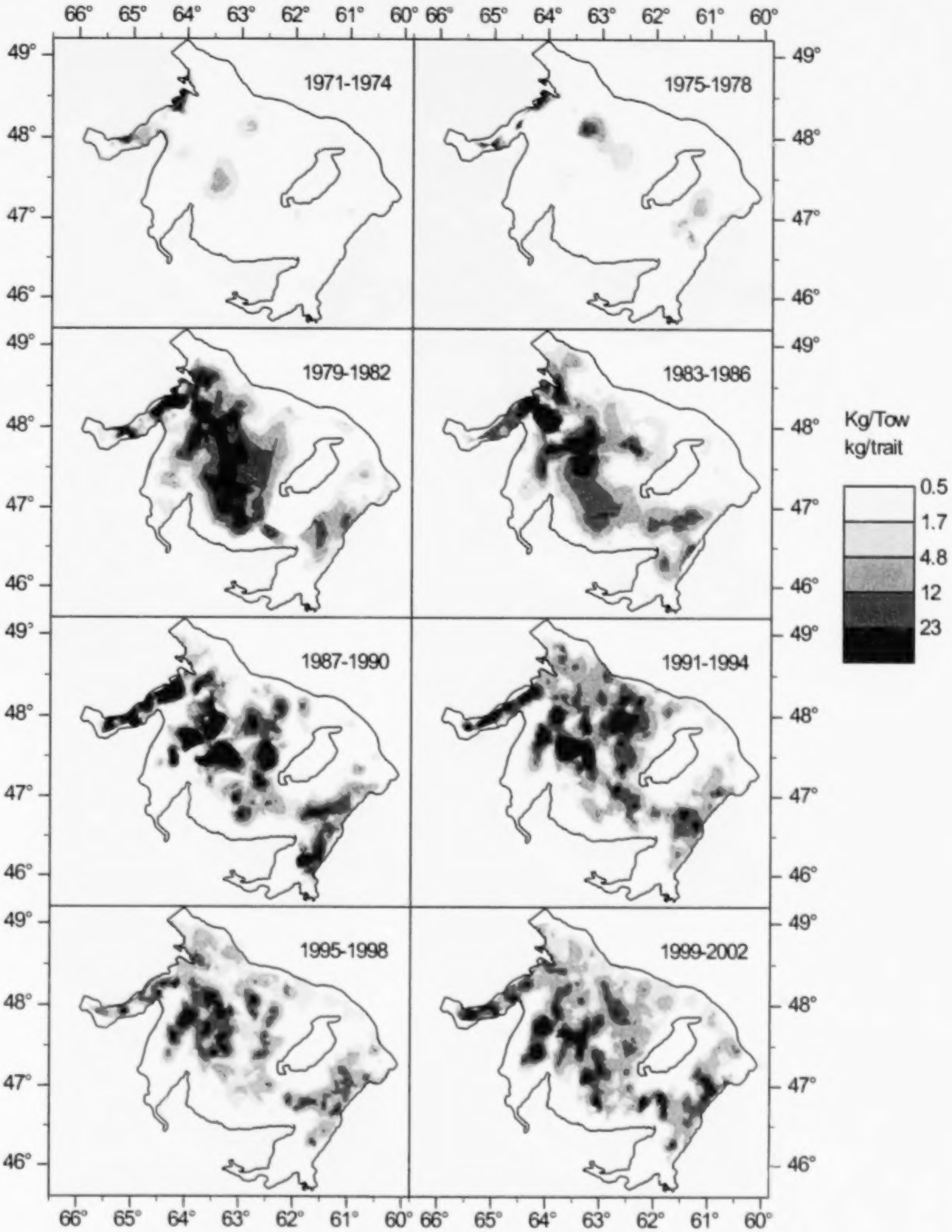

Figure 69. September distribution of catches (kg) of Snow Crab, *Chionoectes opilio*

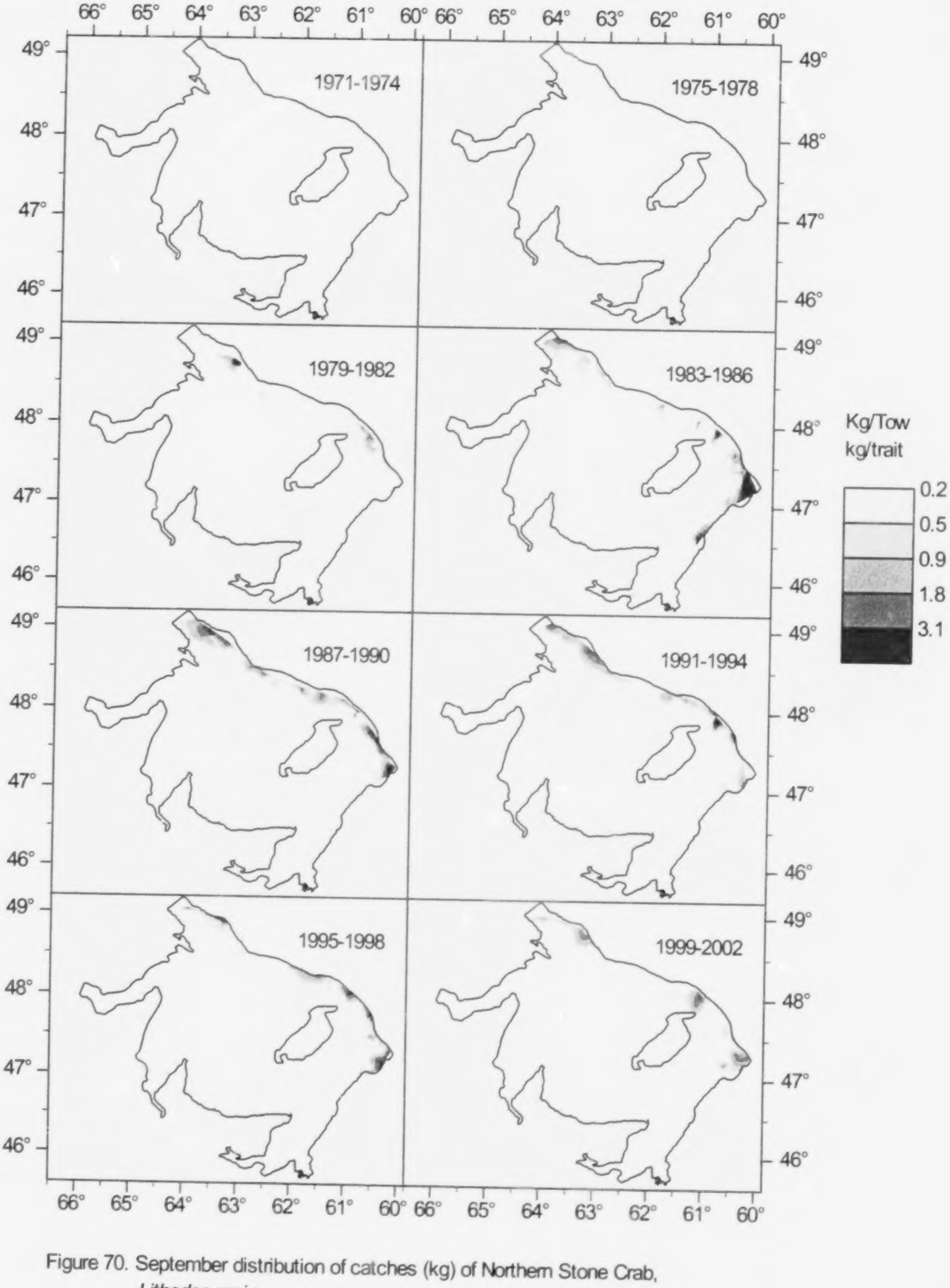

Figure 70. September distribution of catches (kg) of Northern Stone Crab, *Lithodes maja*

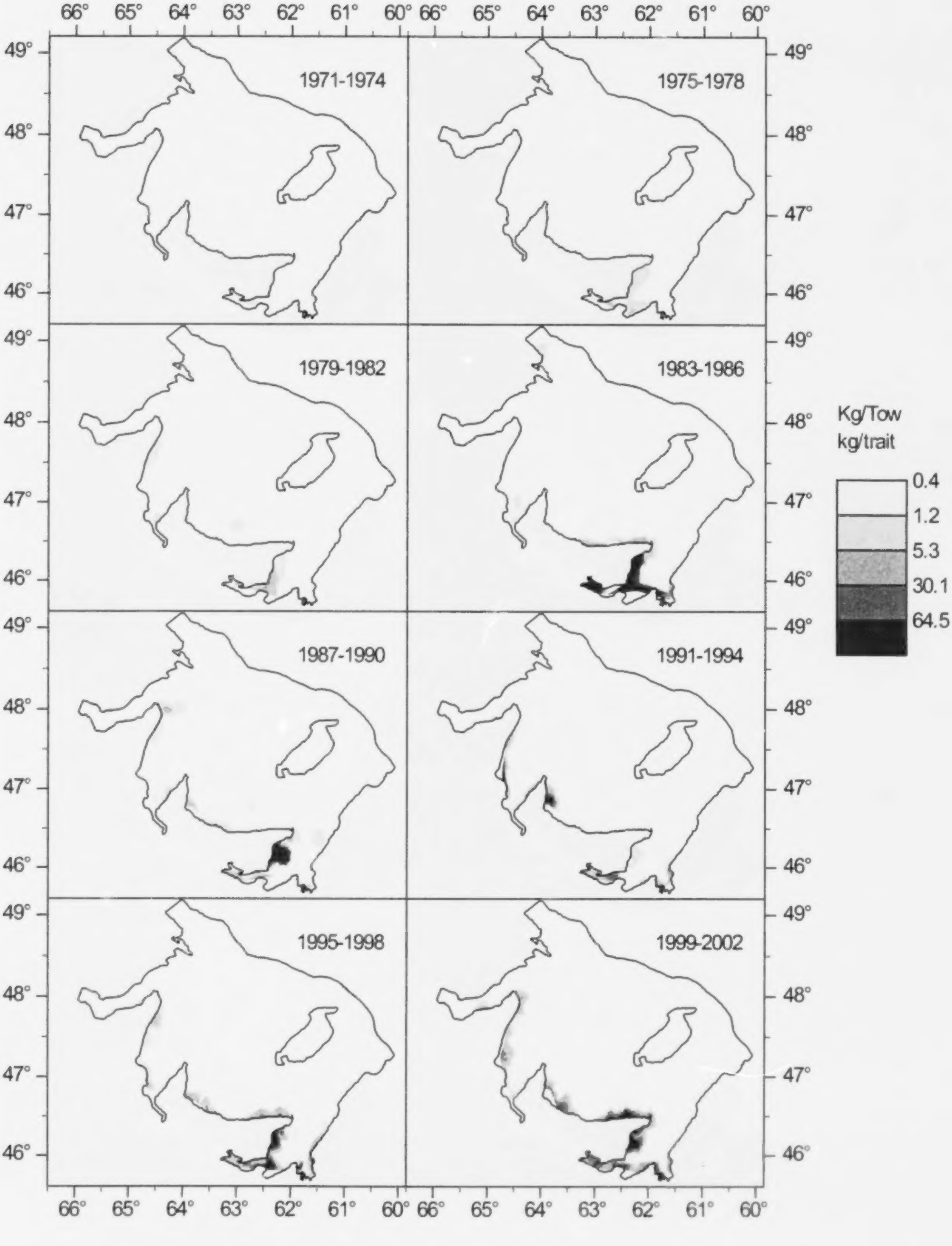

Figure 71. September distribution of catches (kg) of Lobster, *Homarus americanus*

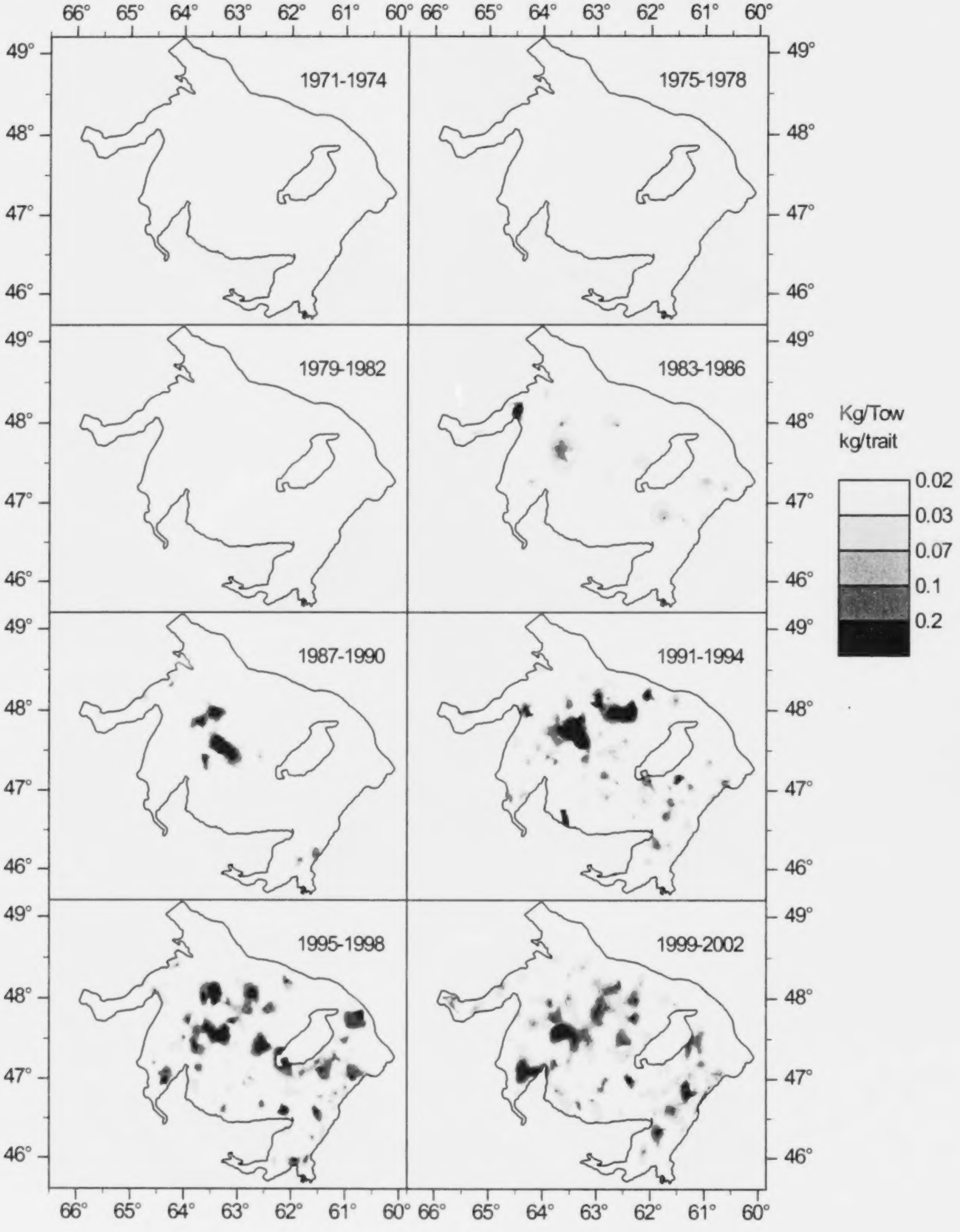

Figure 72. September distribution of catches (kg) of Hermit Crabs, Paguroidae

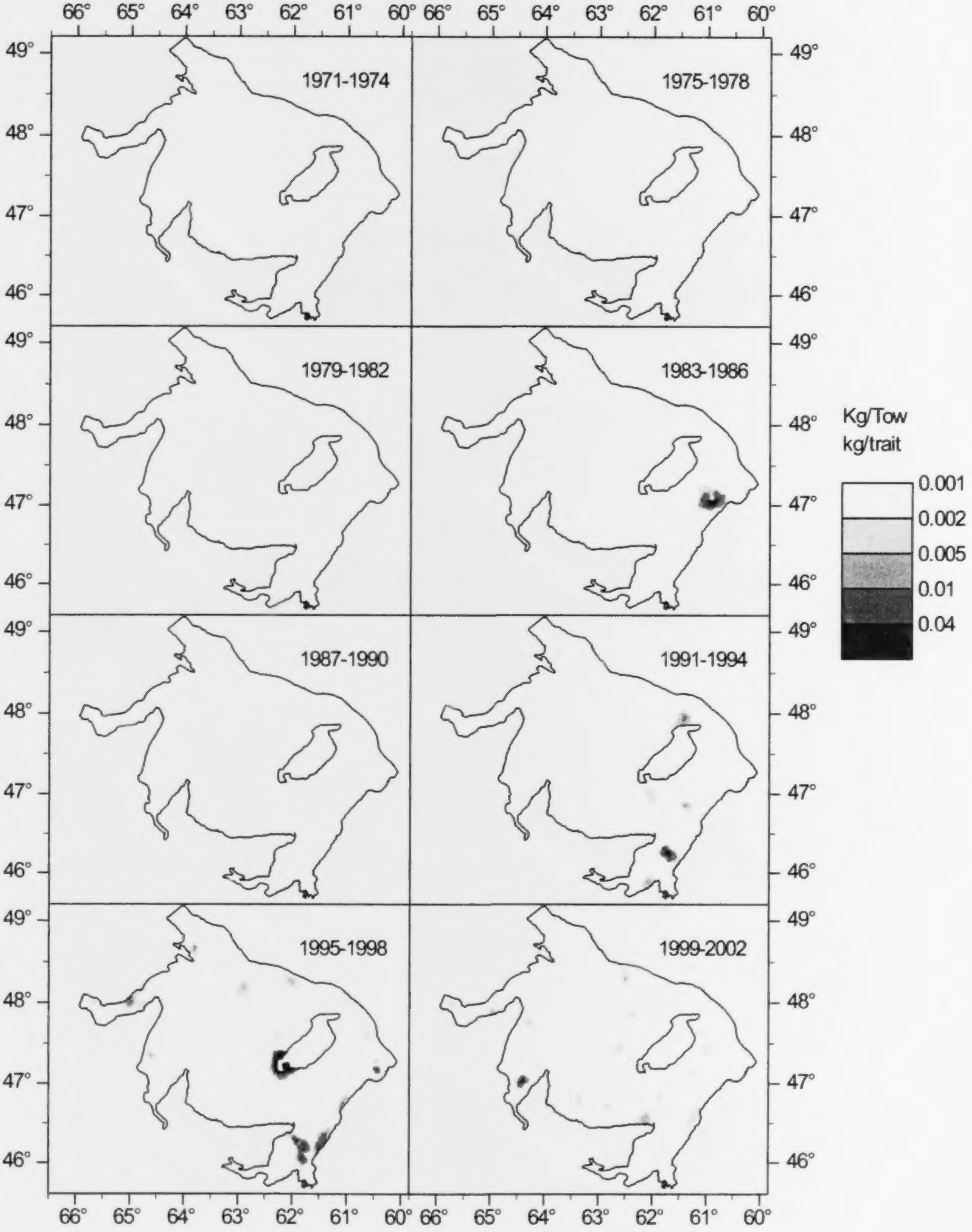

Figure 73. September distribution of catches (kg) of Bristle Worms, Polycheata

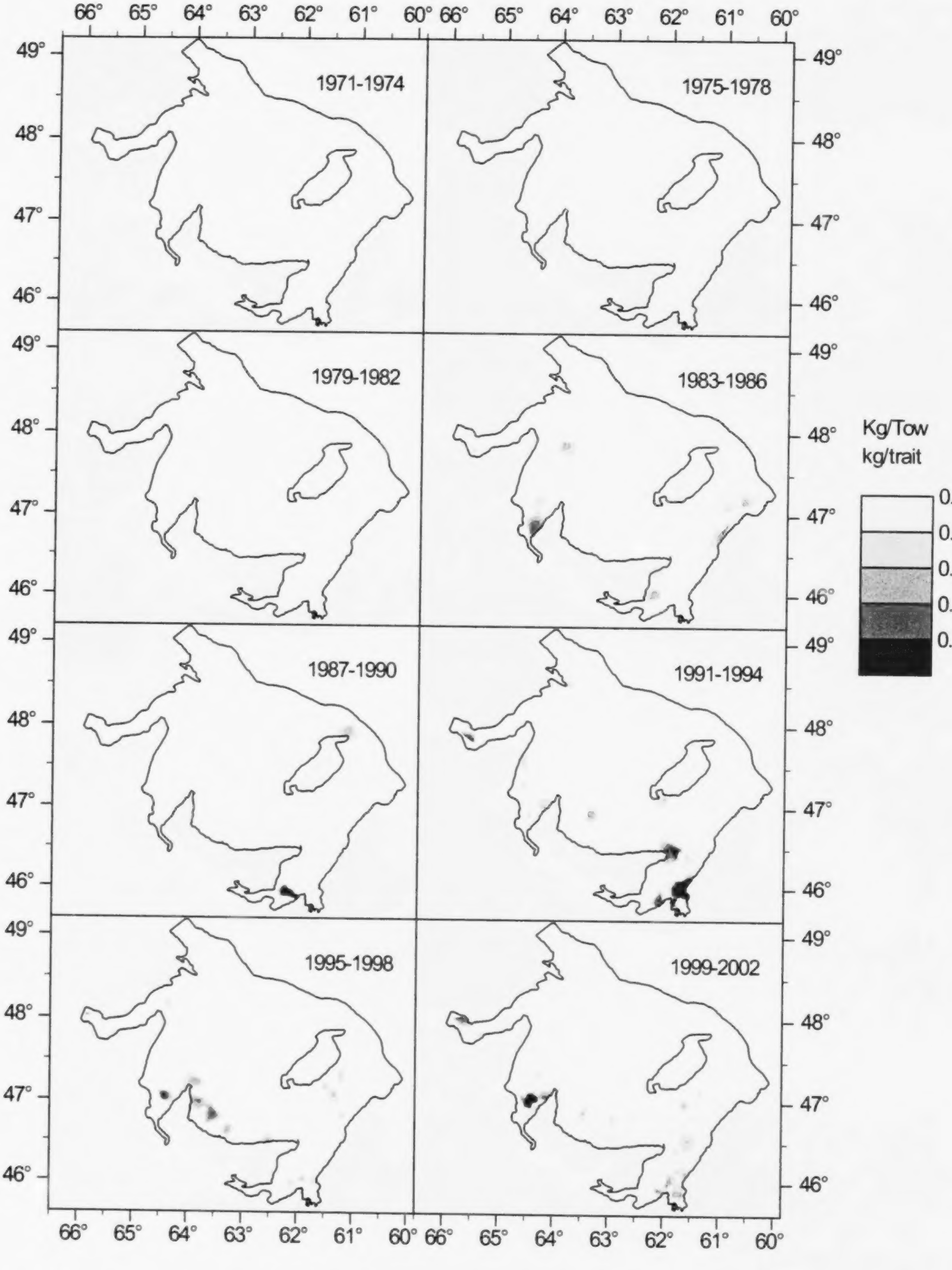

Figure 74. September distribution of catches (kg) of Sea Mice, *Aphrodita sp.*

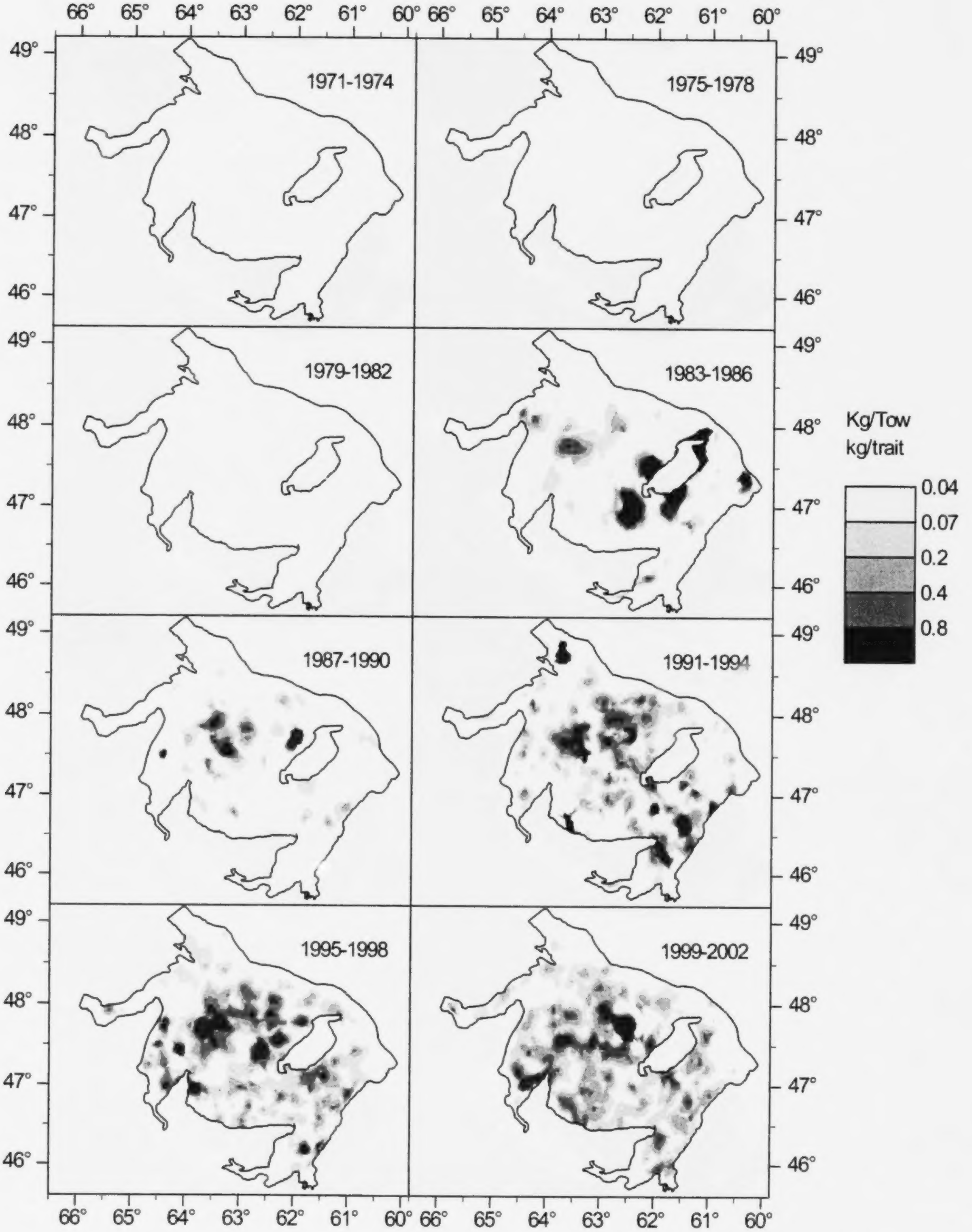

Figure 75. September distribution of catches (kg) of Snails and Slugs, Gastropoda

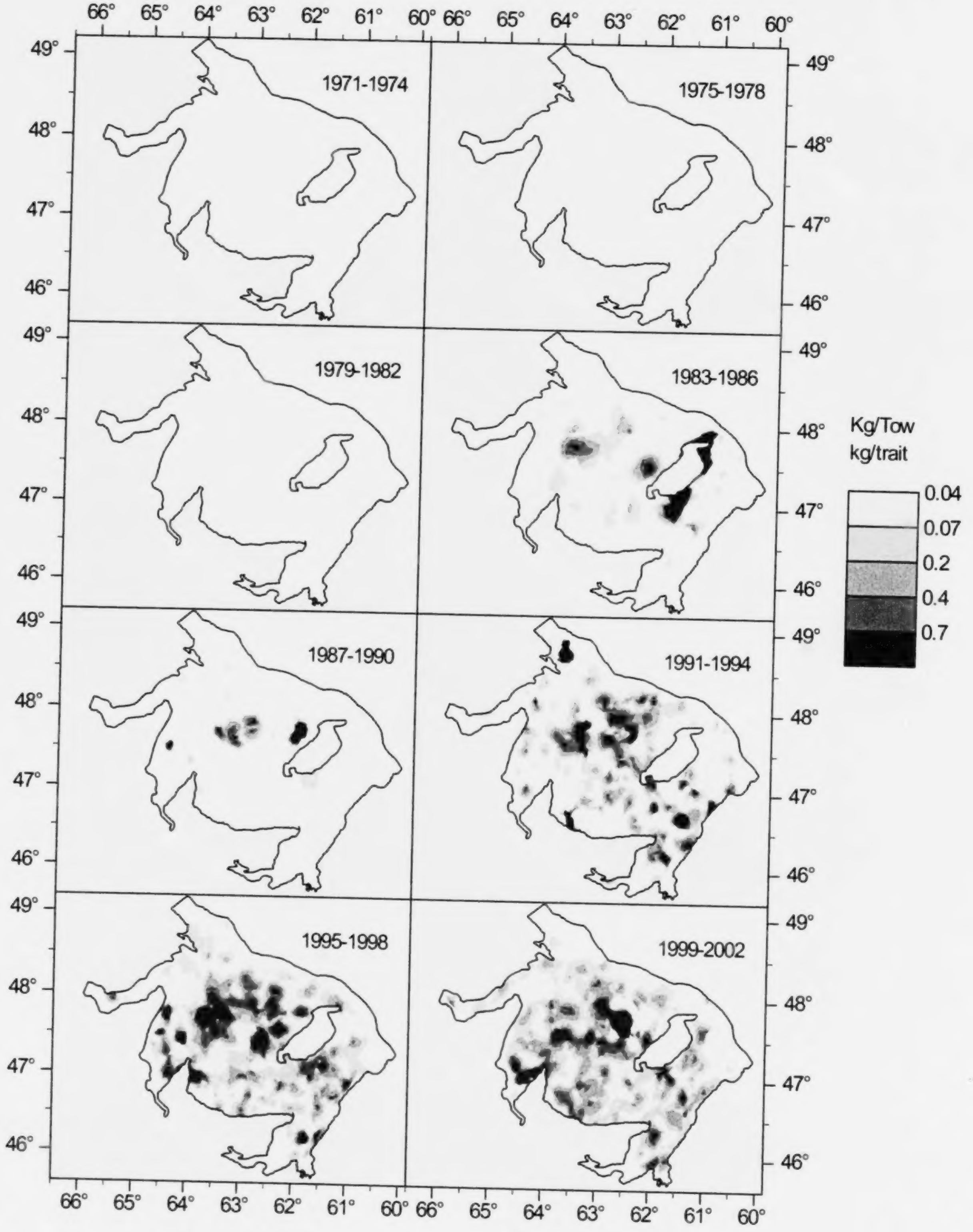

Figure 76. September distribution of catches (kg) of Welks, *Buccinum sp.*

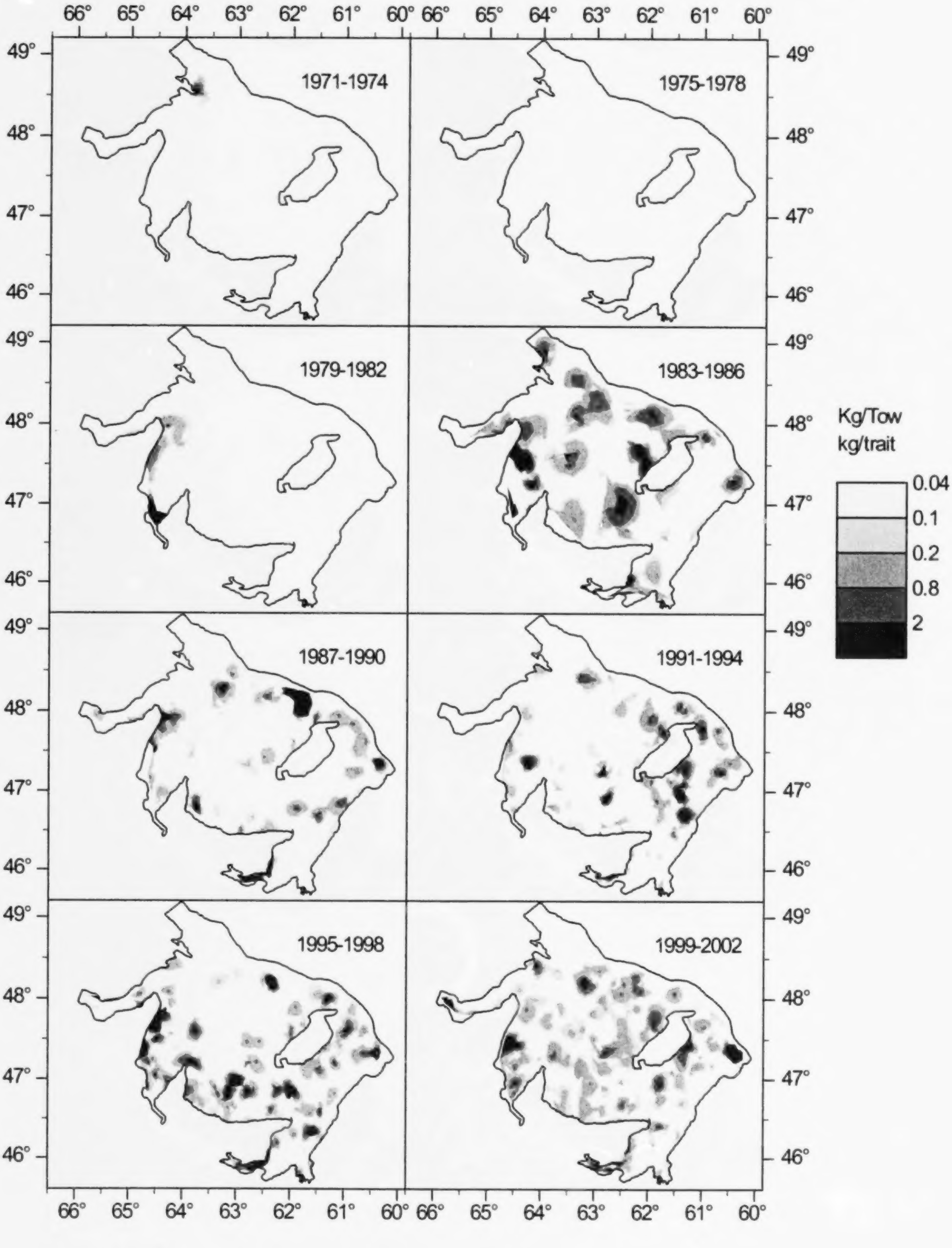

Figure 77. September distribution of catches (kg) of Bivalve Molluscs,
Bivalvia

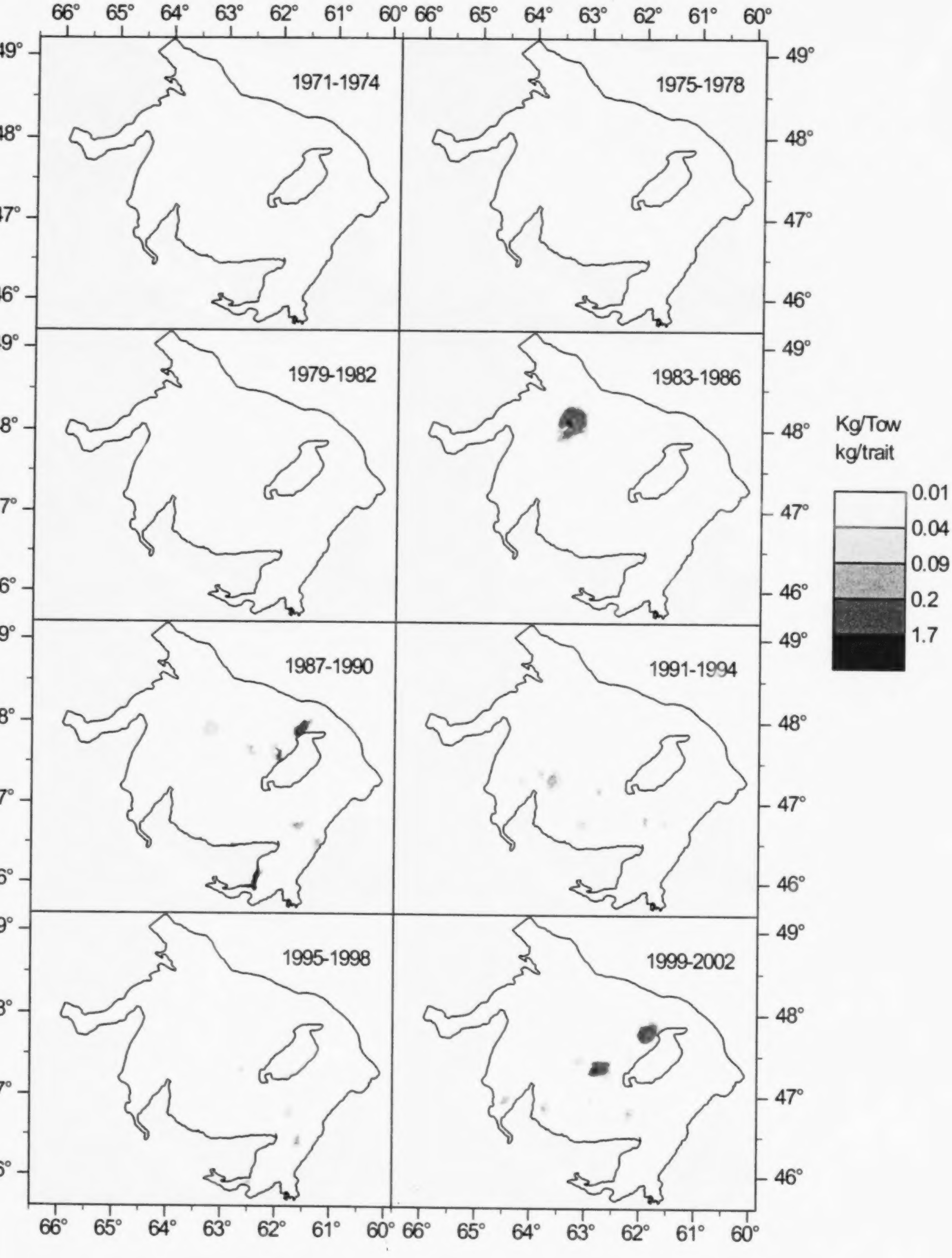

Figure 78. September distribution of catches (kg) of Clams,
Cryptodonta, Pterimorphia, Palaeotaxodonta, Heterodonta, Prionodesmata, Teleodesmata

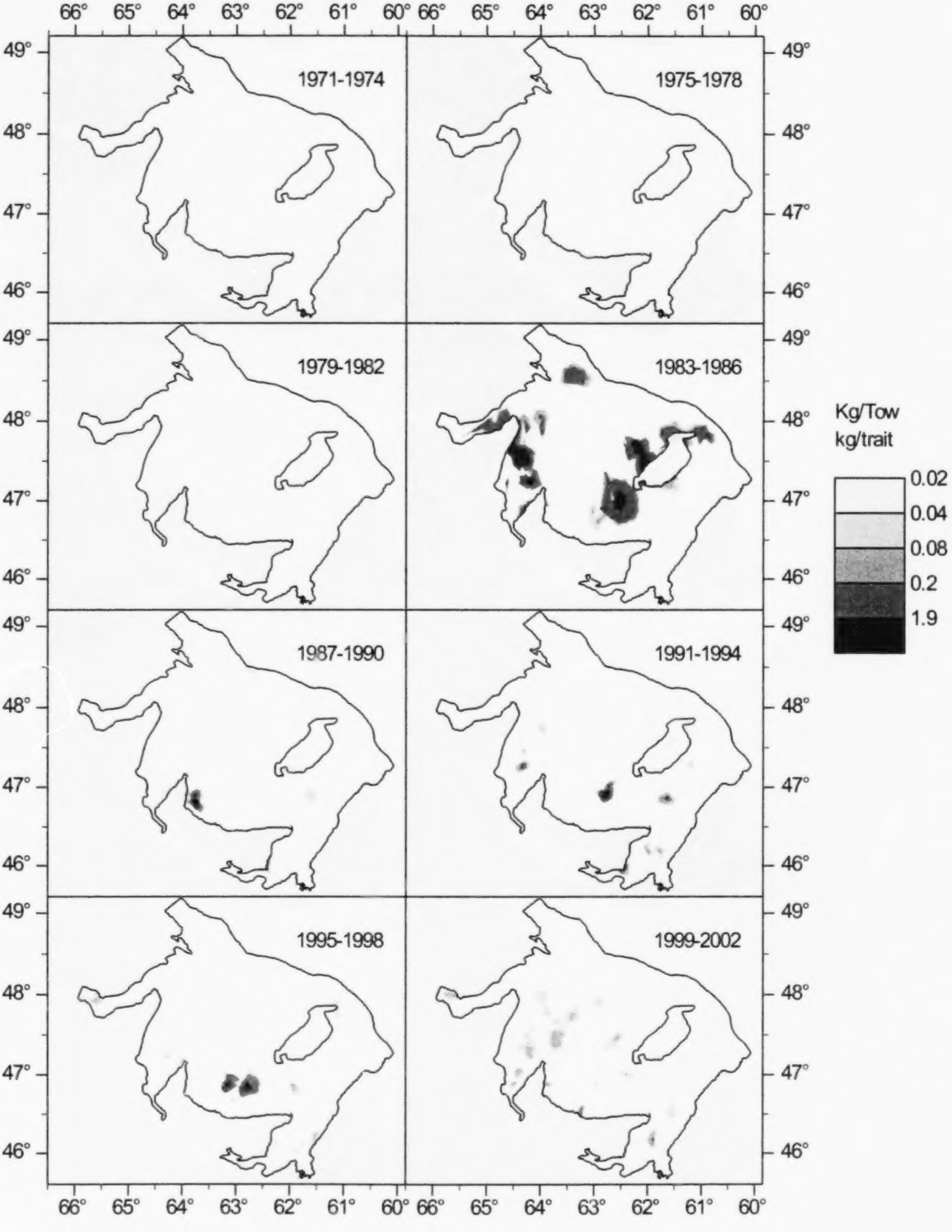

Figure 79. September distribution of catches (kg) of Ocean Quahog,
Arctica islandica

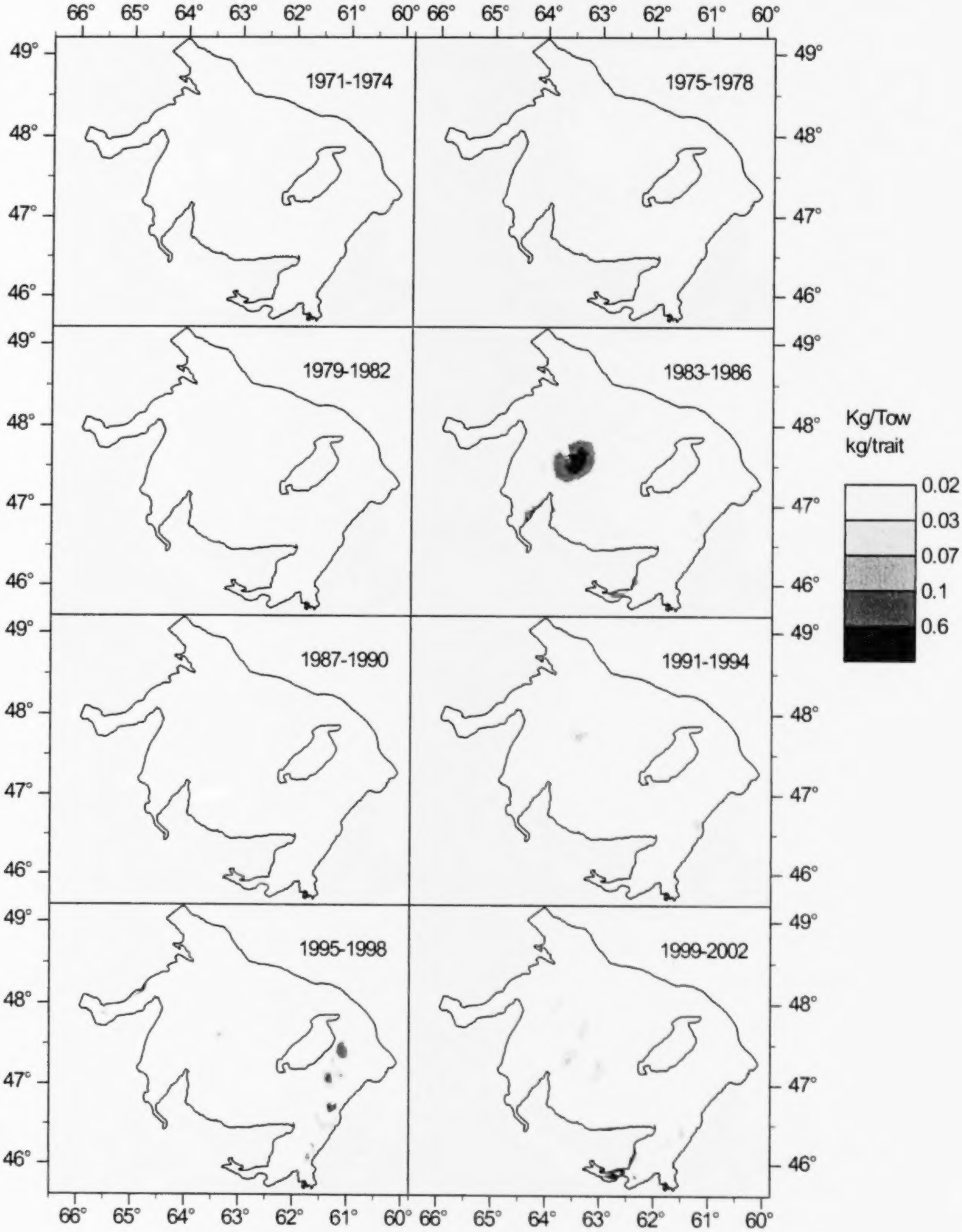

Figure 80. September distribution of catches (kg) of Cockles, Cardiidae

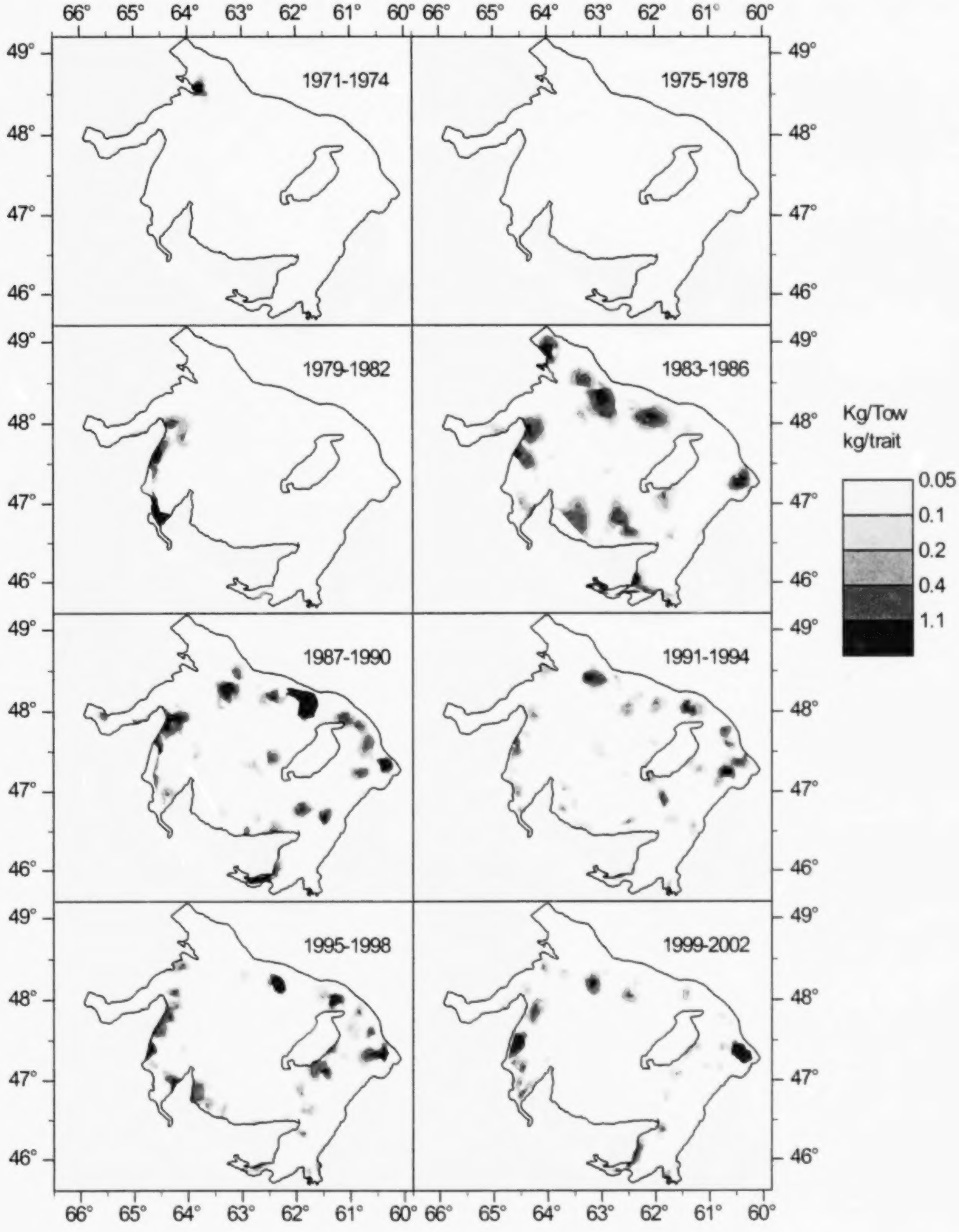

Figure 81. September distribution of catches (kg) of Scallops, Pectinidae

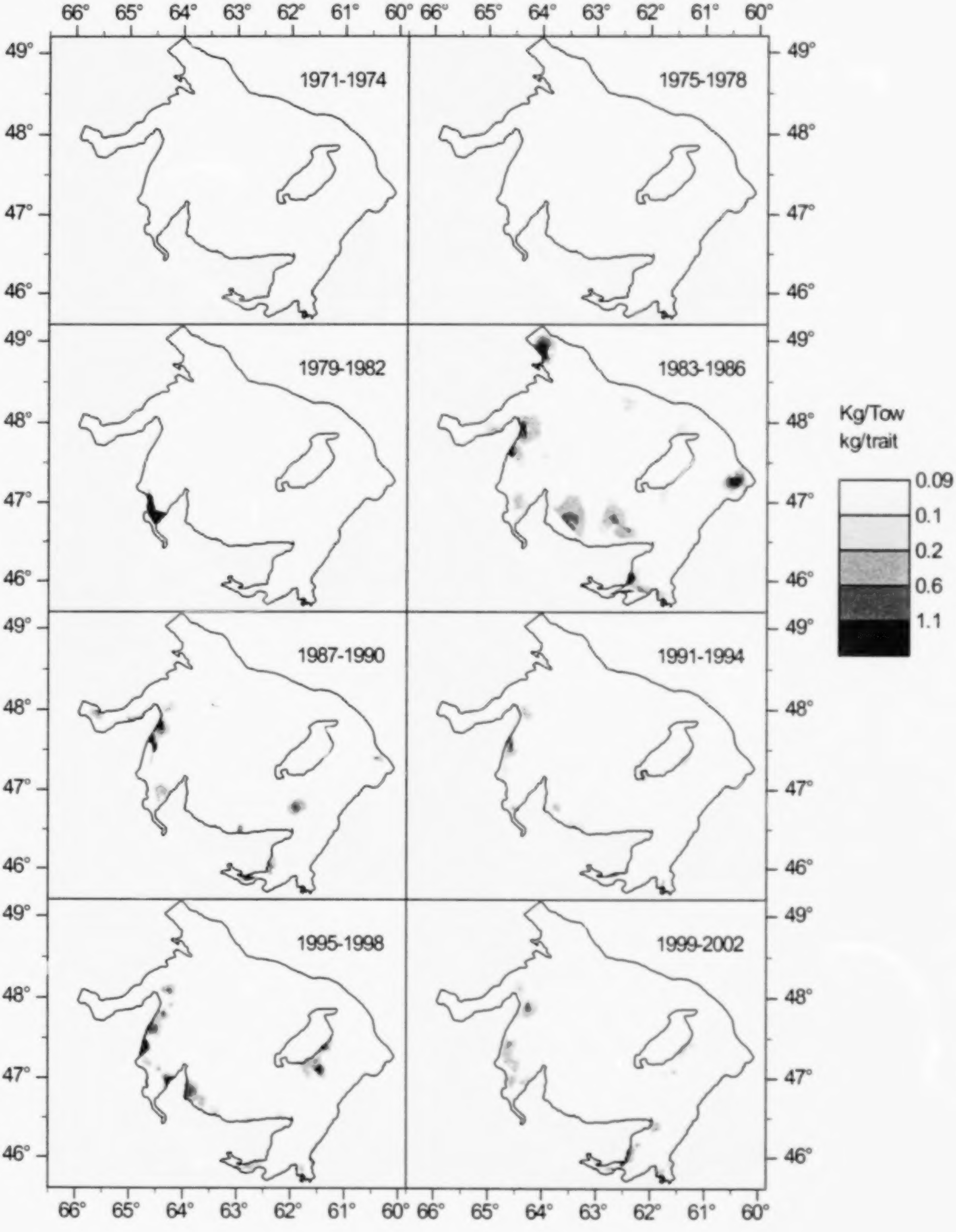

Figure 82. September distribution of catches (kg) of Sea Scallop,
Placopecten magellanicus

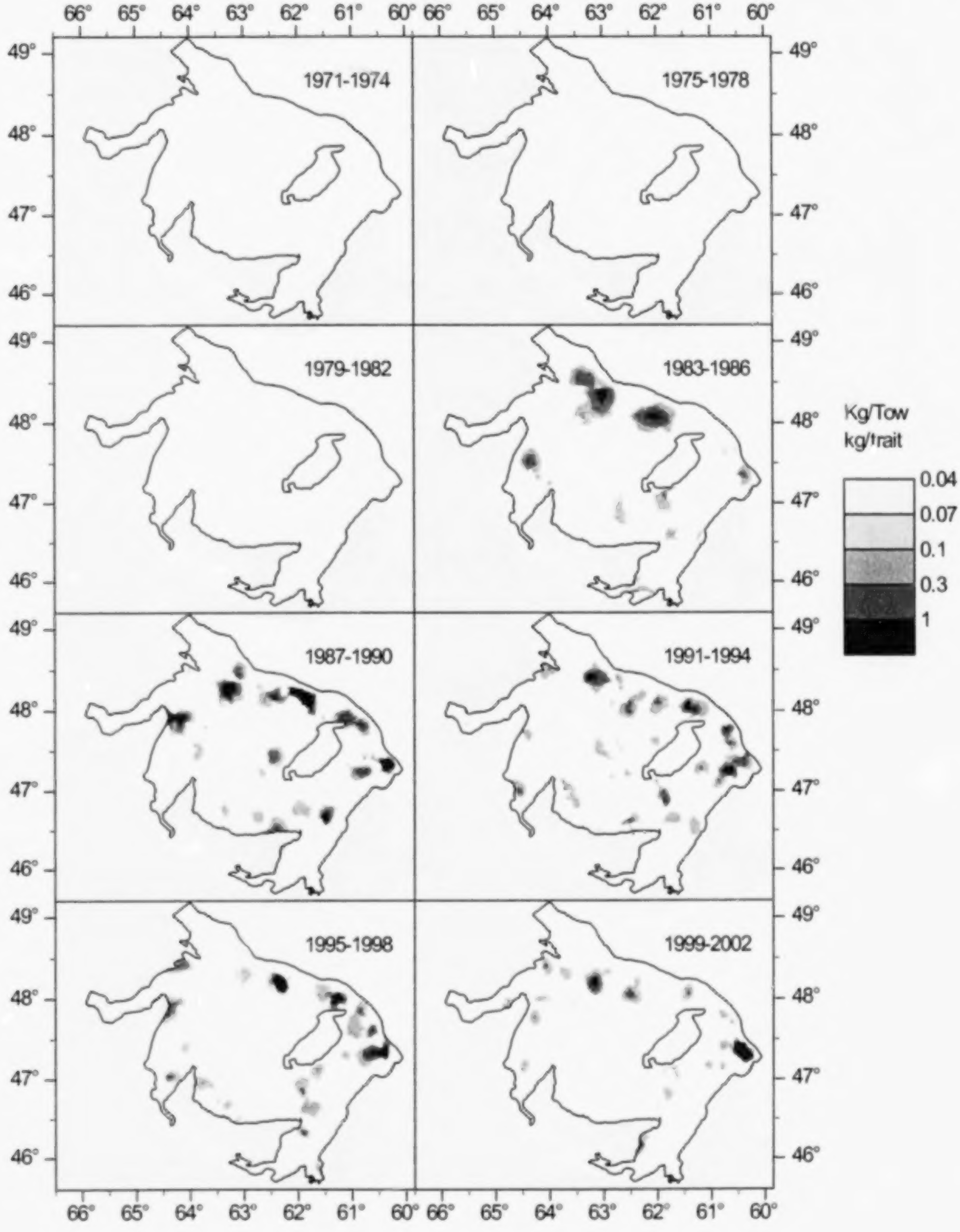

Figure 83. September distribution of catches (kg) of Iceland Scallop, *Chlamys islandicus*

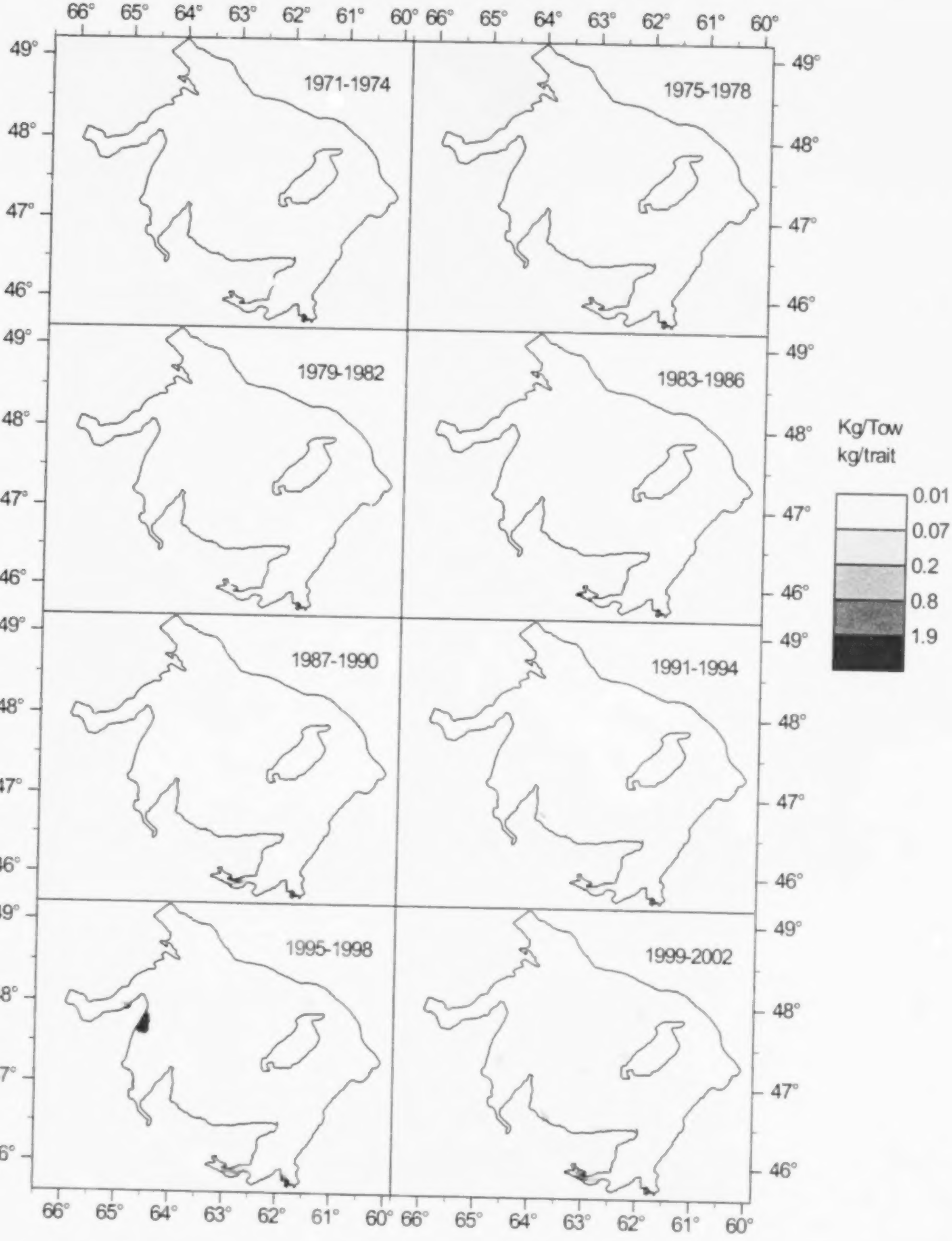

Figure 84. September distribution of catches (kg) of True Mussels, Mytilidae

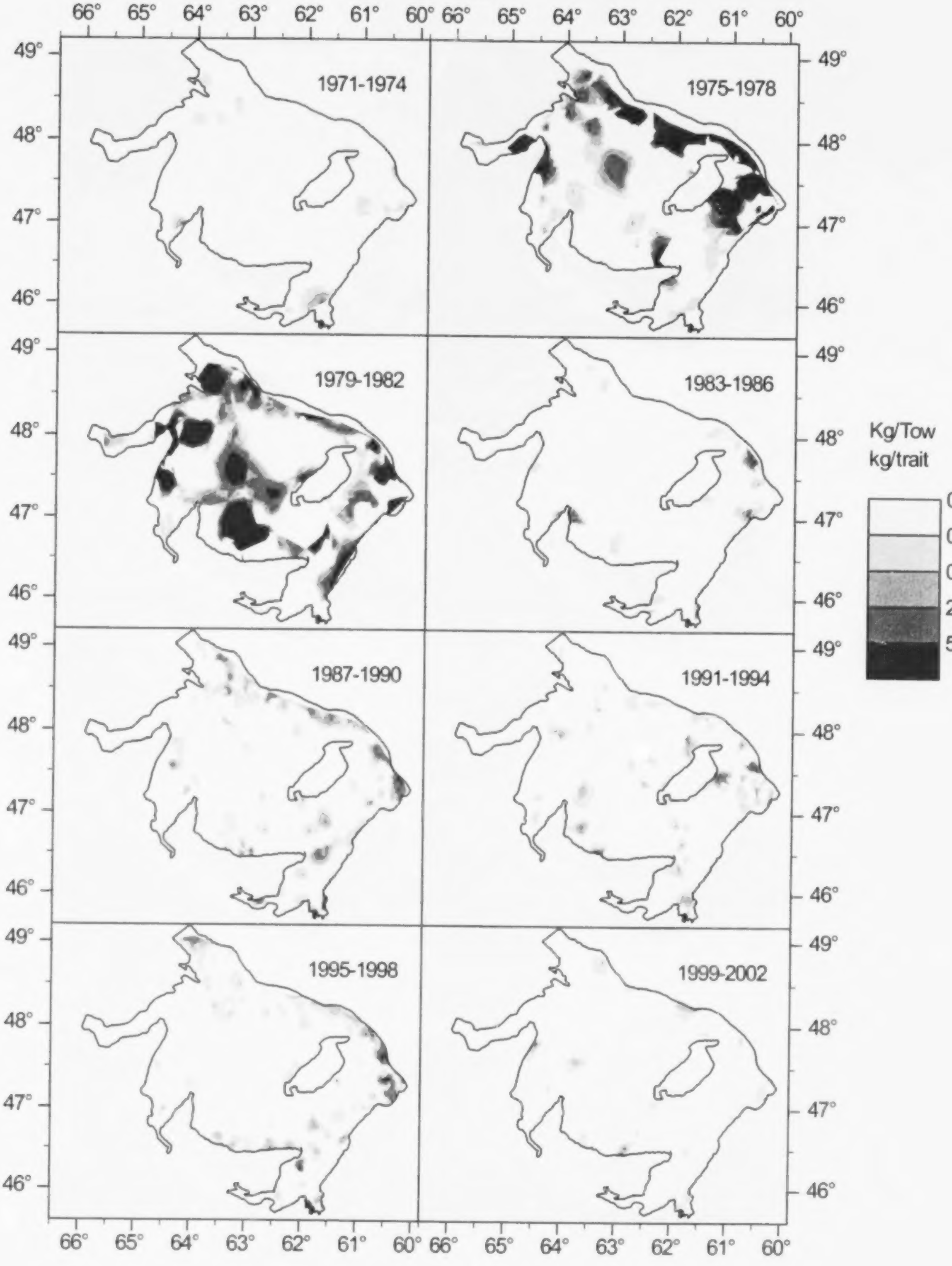

Figure 85. September distribution of catches (kg) of Squids, Loliginidae, Ommastrephidae

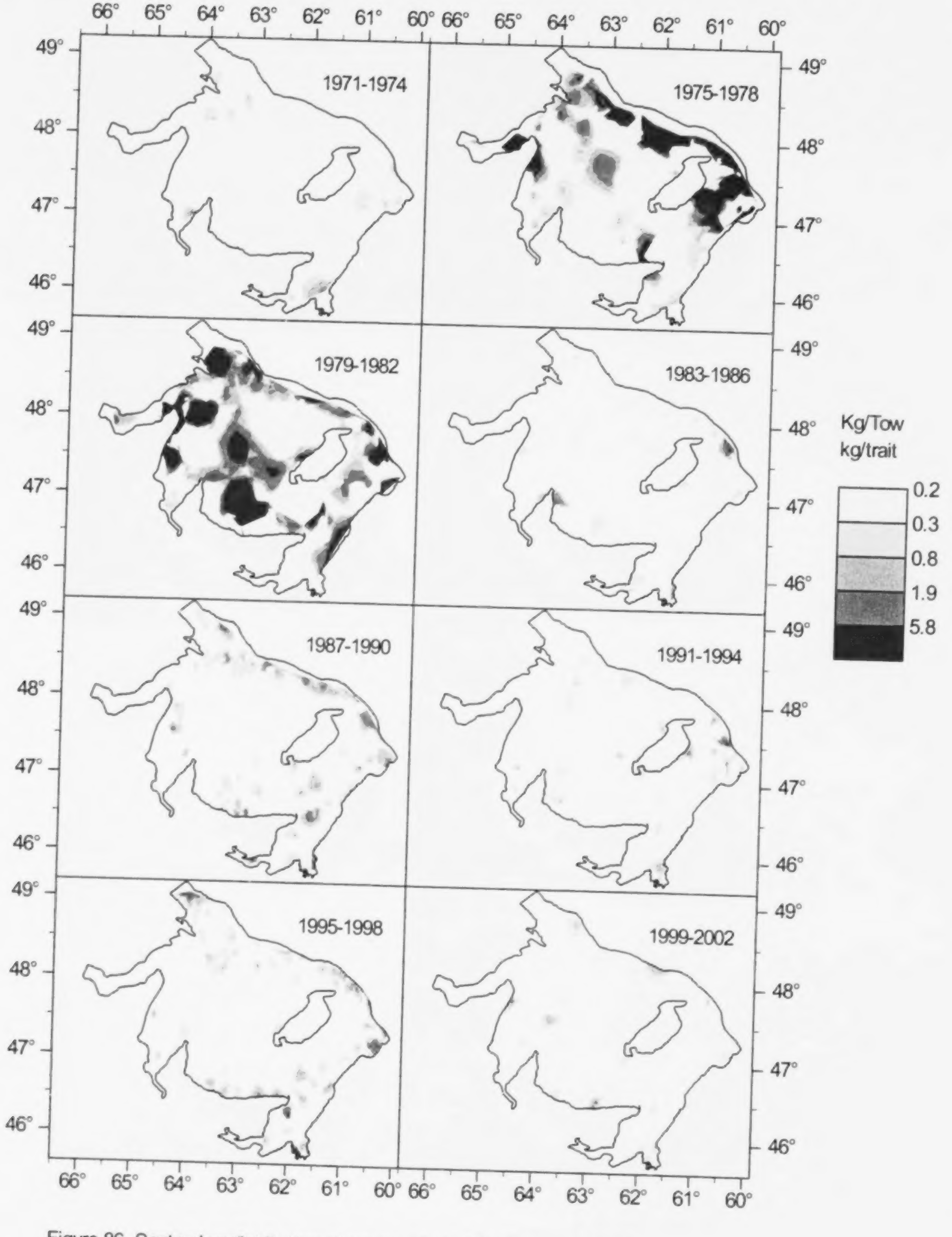

Figure 86. September distribution of catches (kg) of Short-Finned Squid, *Illex illecebrosus*

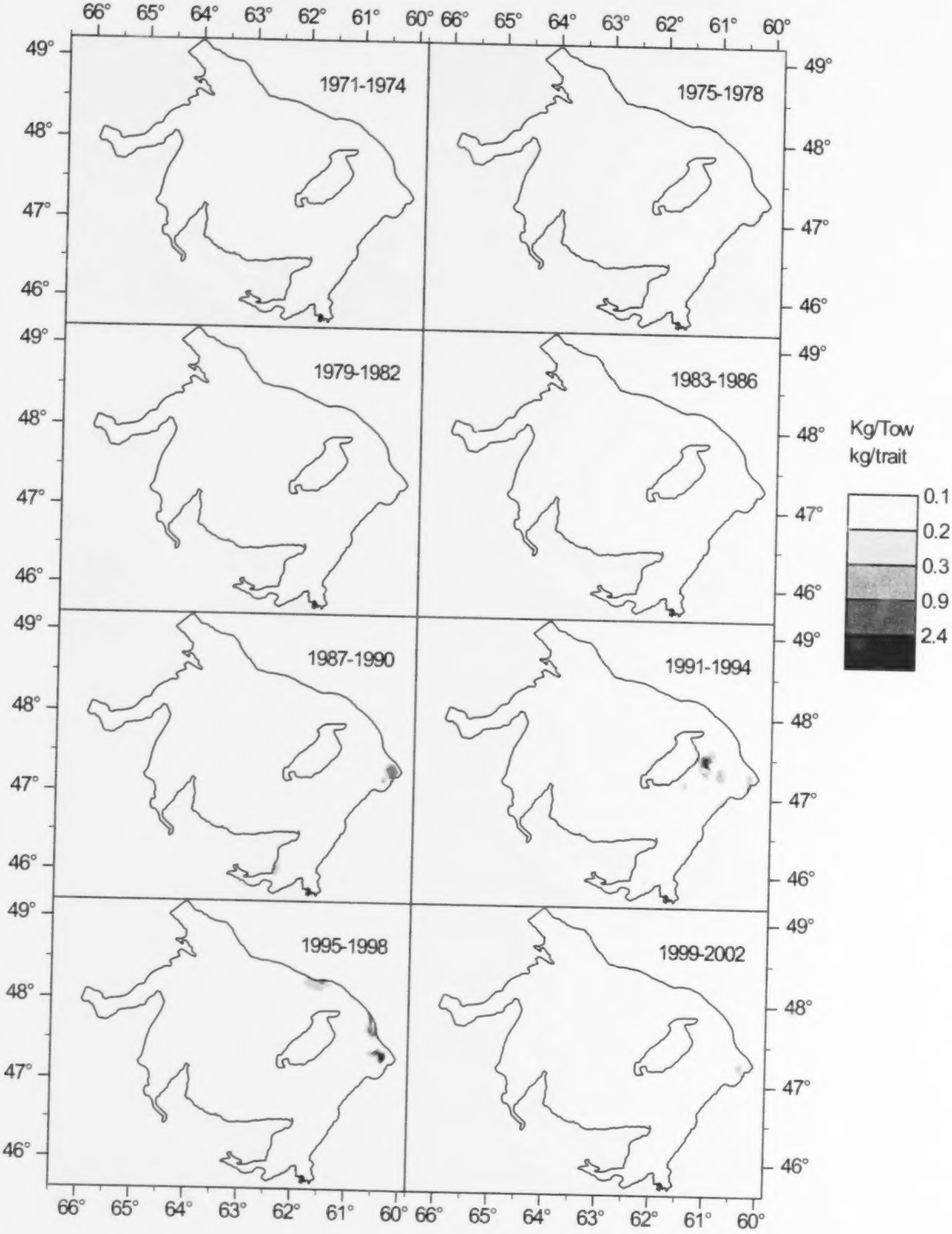

Figure 87. September distribution of catches (kg) of Long-Finned Squid, *Loligo pealei*

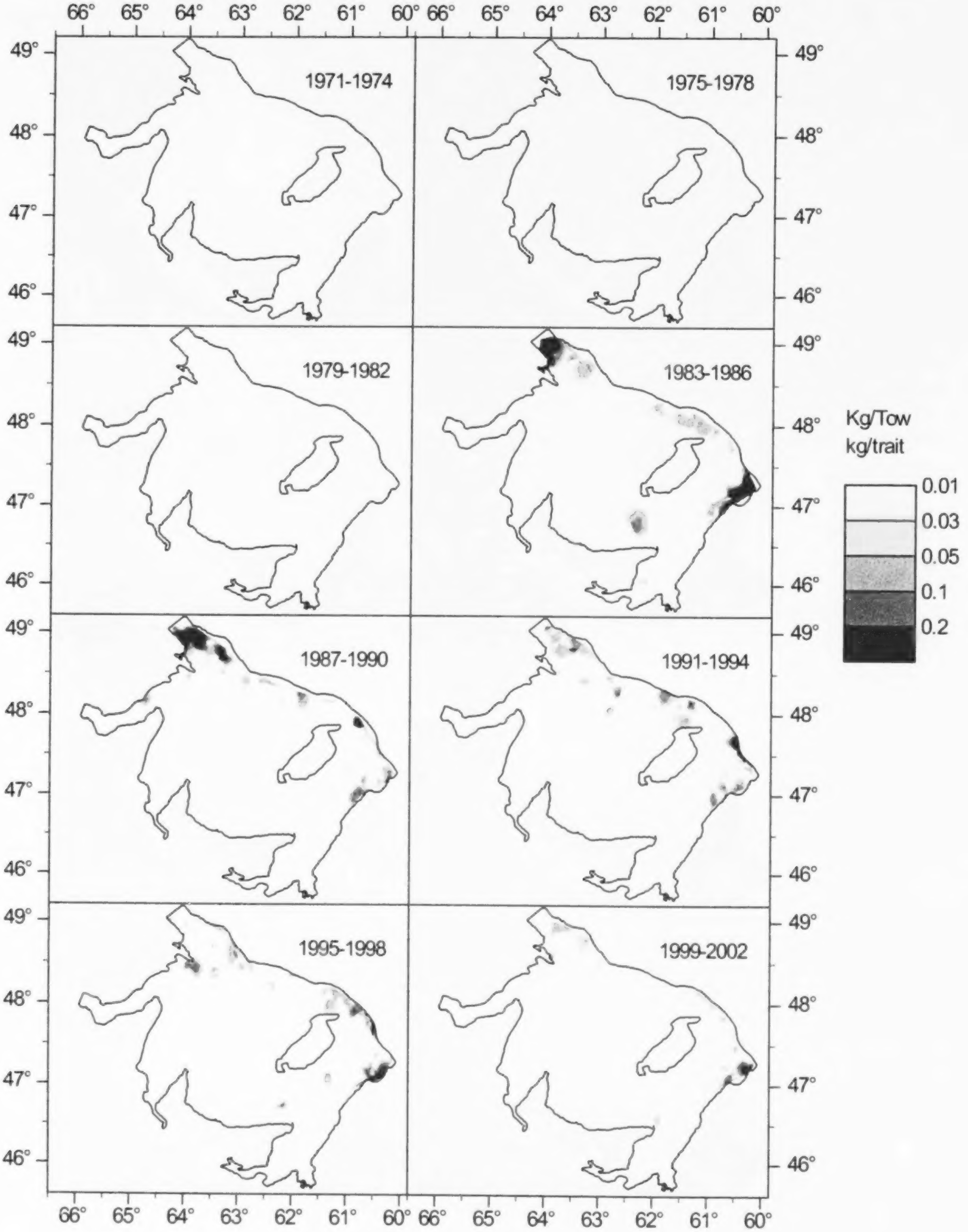

Figure 88. September distribution of catches (kg) of Octopus, Octopoda

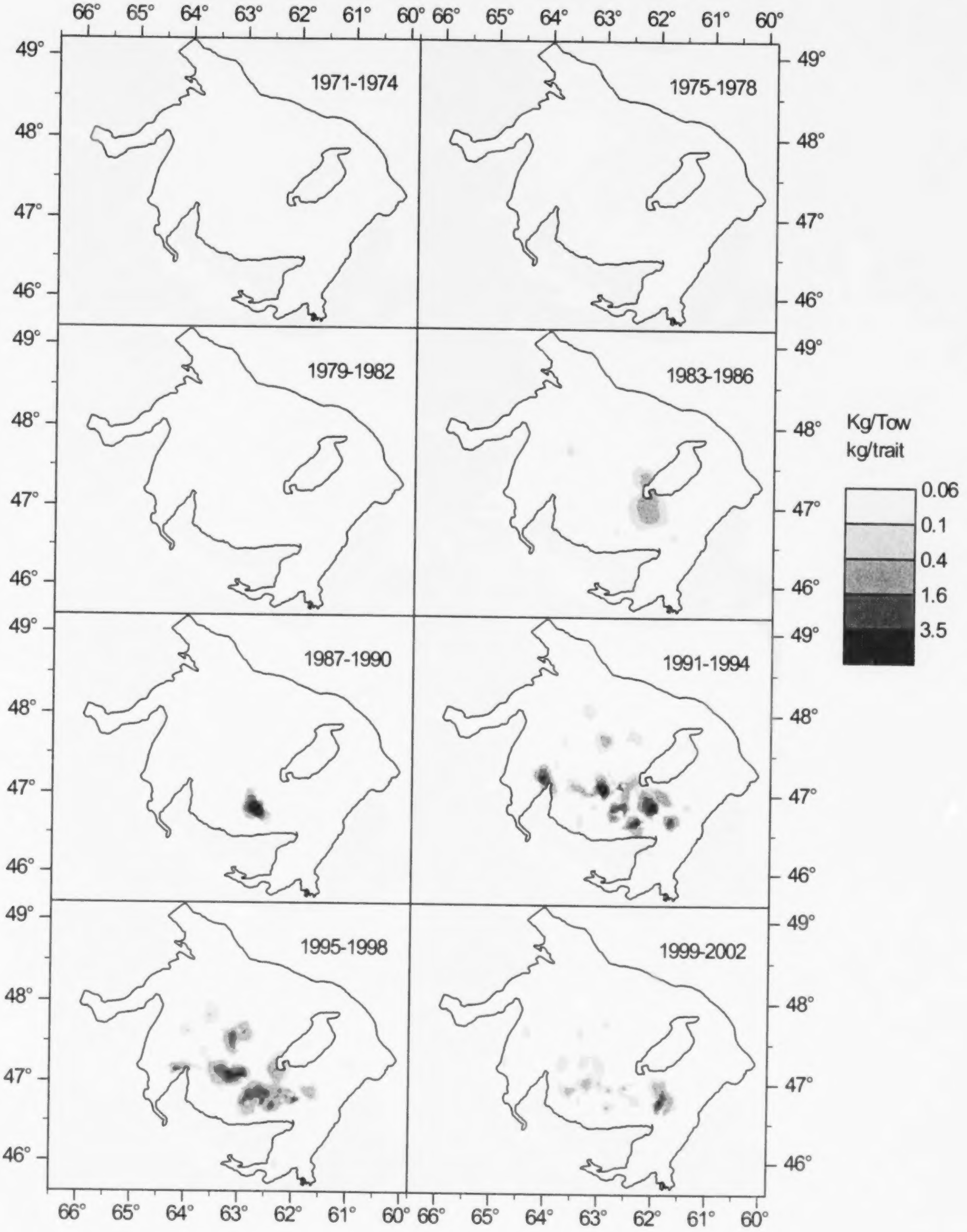

Figure 89. September distribution of catches (kg) of Chitons, Polyplacophora

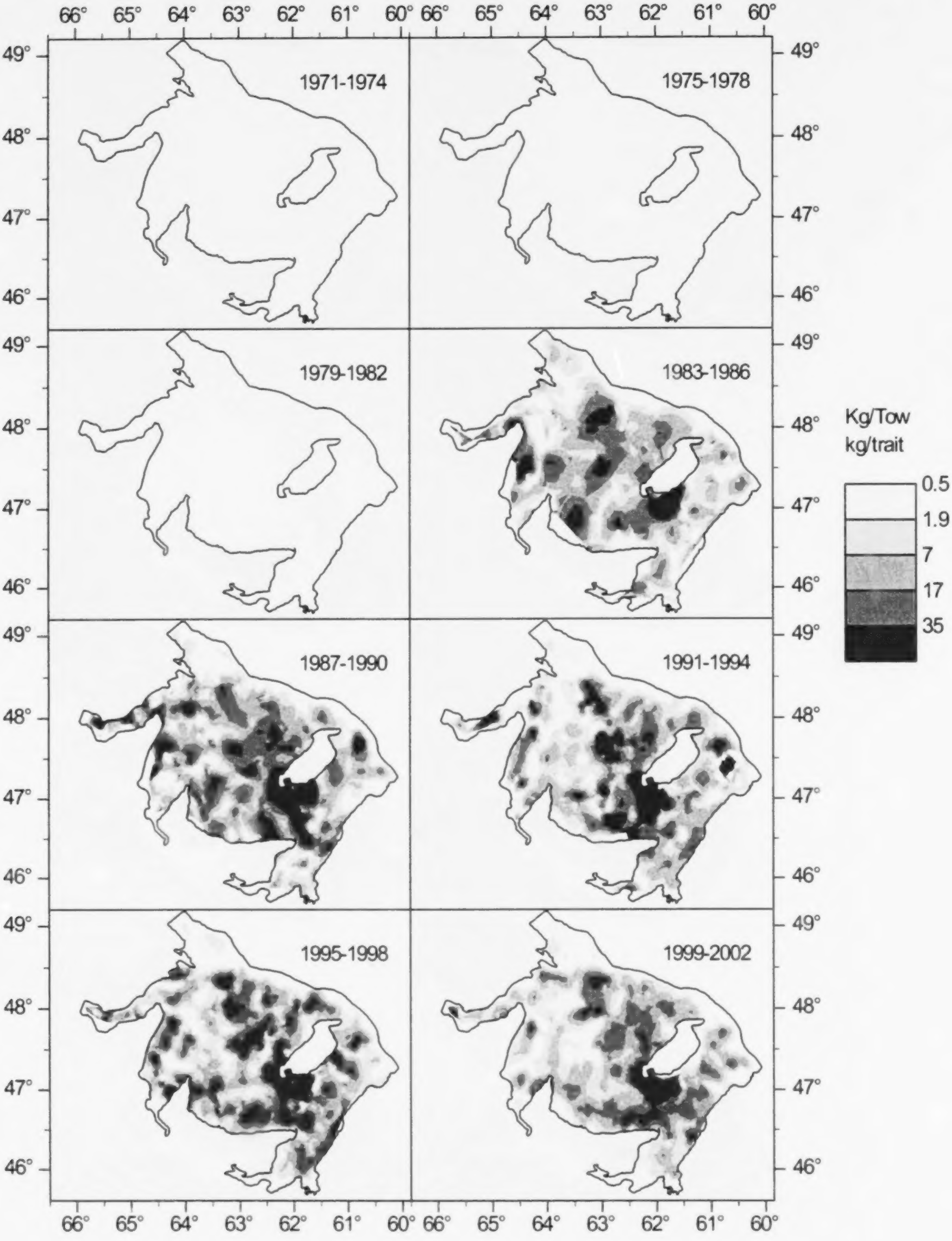

Figure 90. September distribution of catches (kg) of Echinoderms, Echinodermata

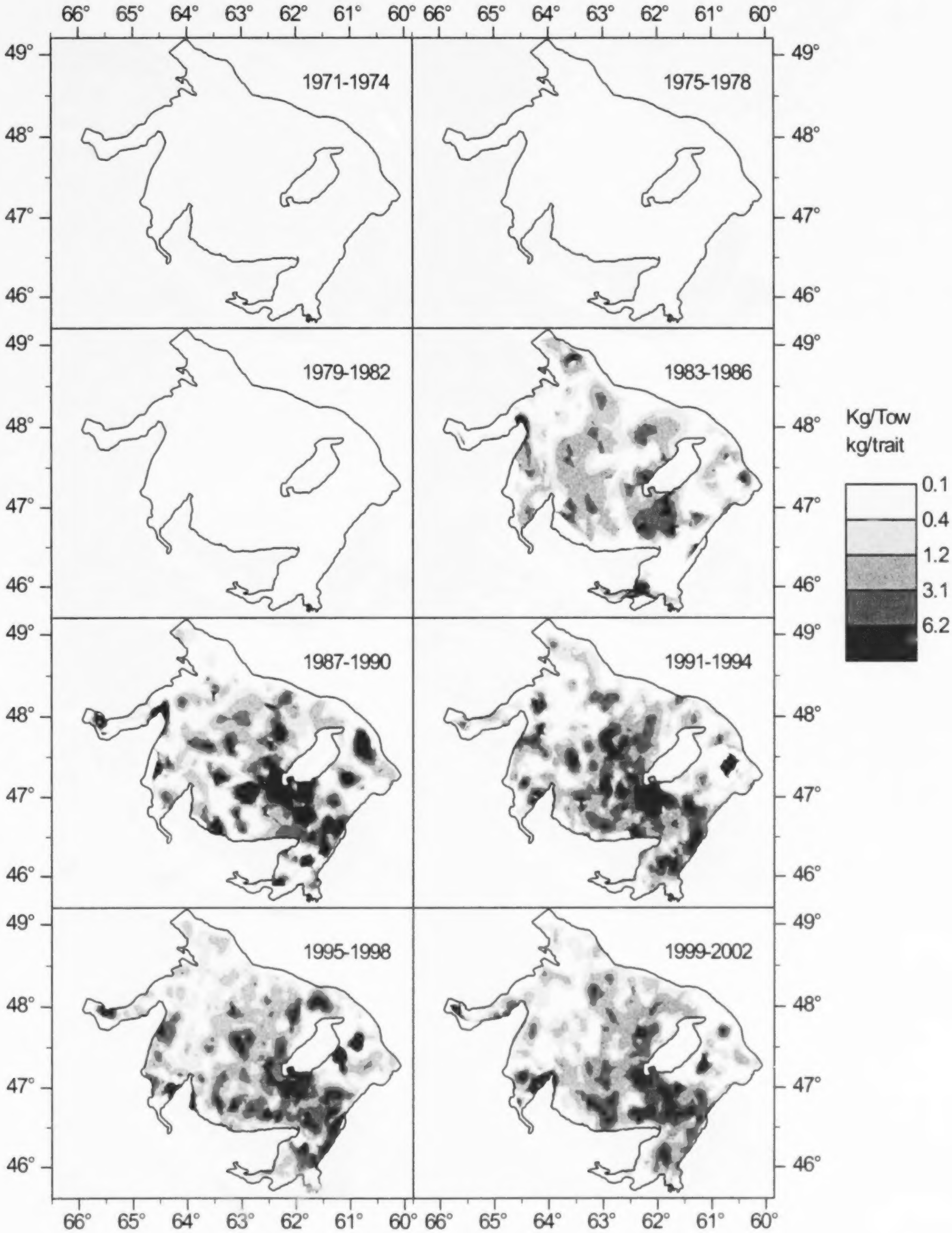

Figure 91. September distribution of catches (kg) of Starfish, Asteroidea

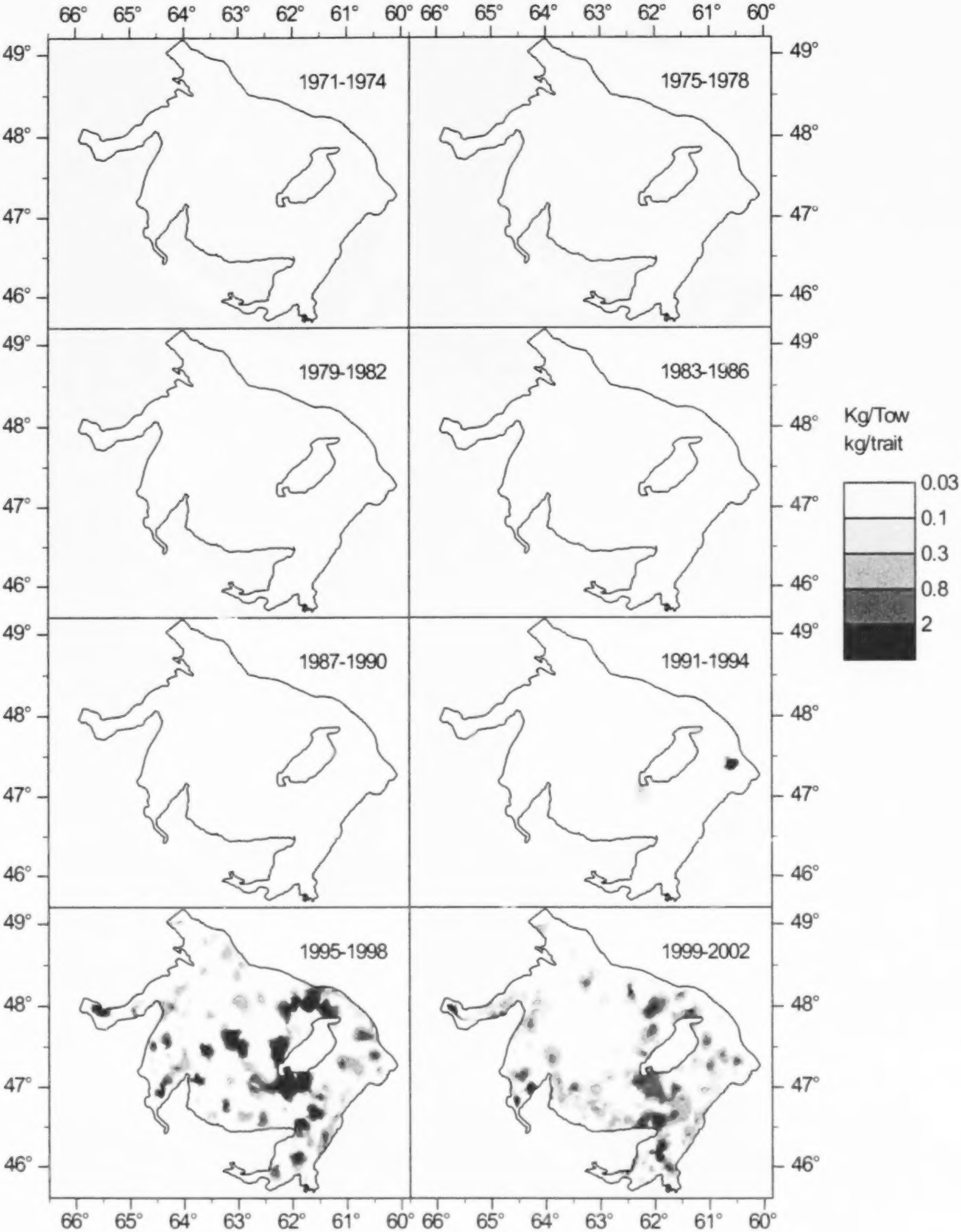

Figure 92. September distribution of catches (kg) of Unidentified Starfish, *Asterias sp.*

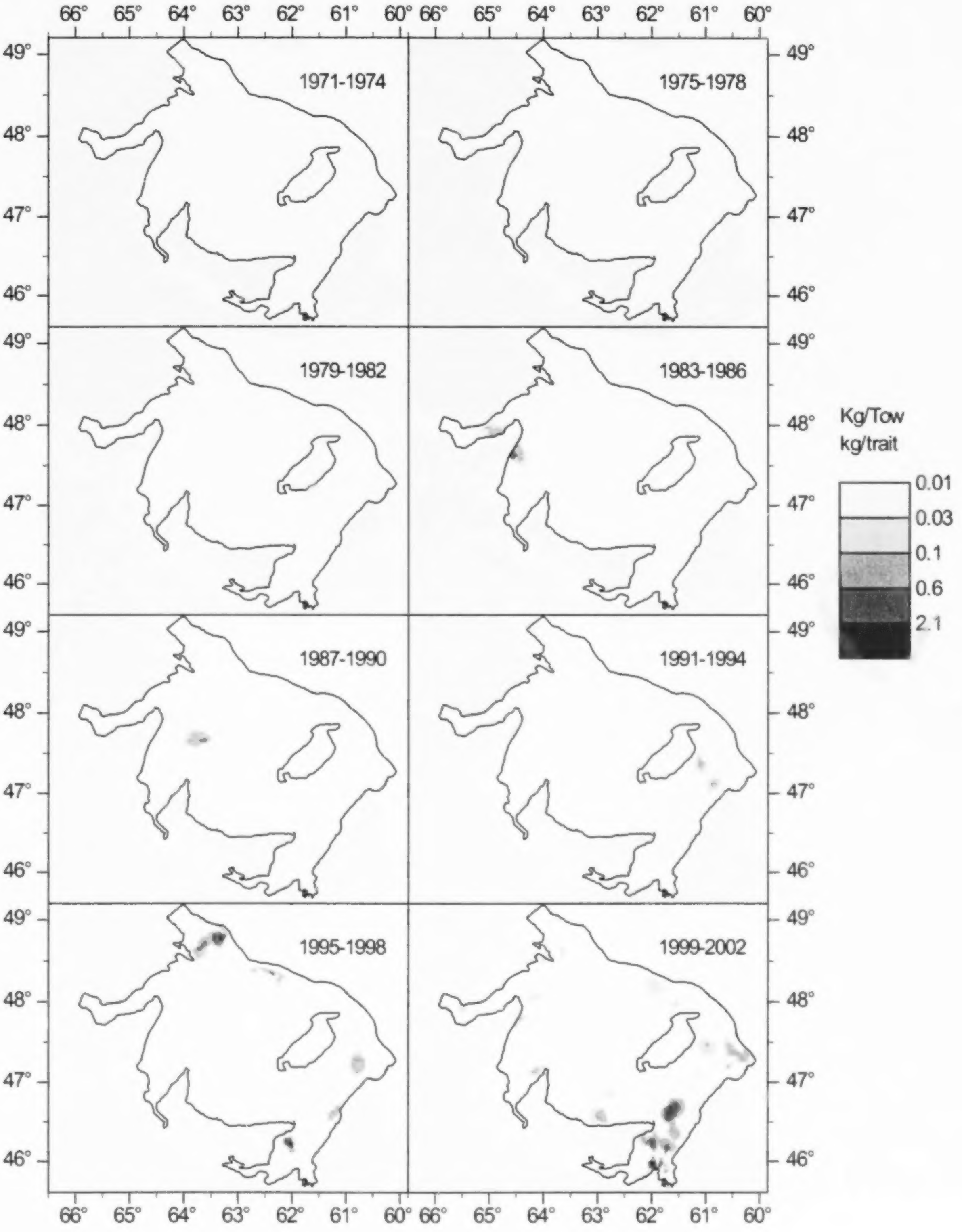

Figure 93. September distribution of catches (kg) of Blood Star,
Henricia sanguinolenta

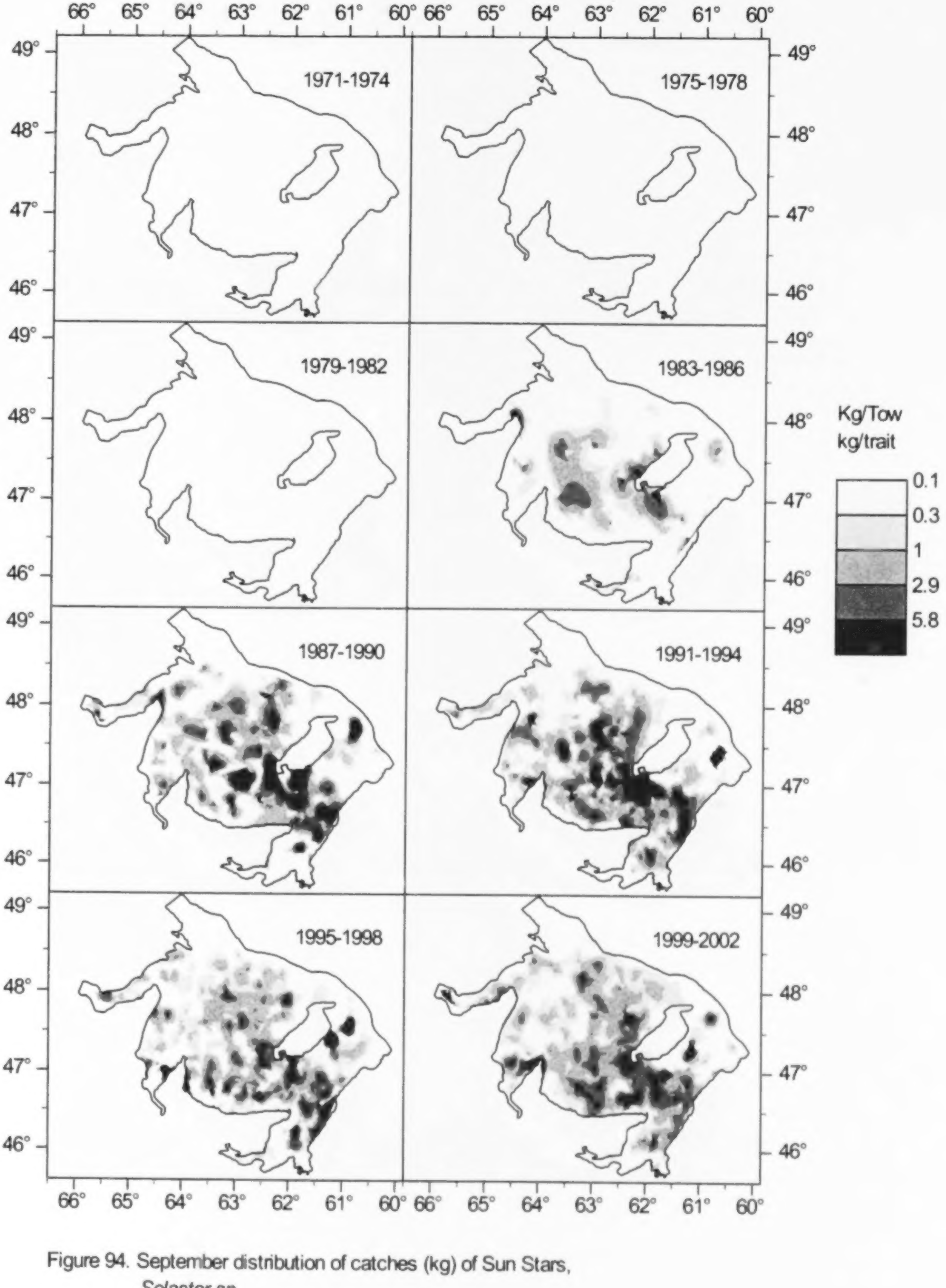

Figure 94. September distribution of catches (kg) of Sun Stars, *Solaster sp.*

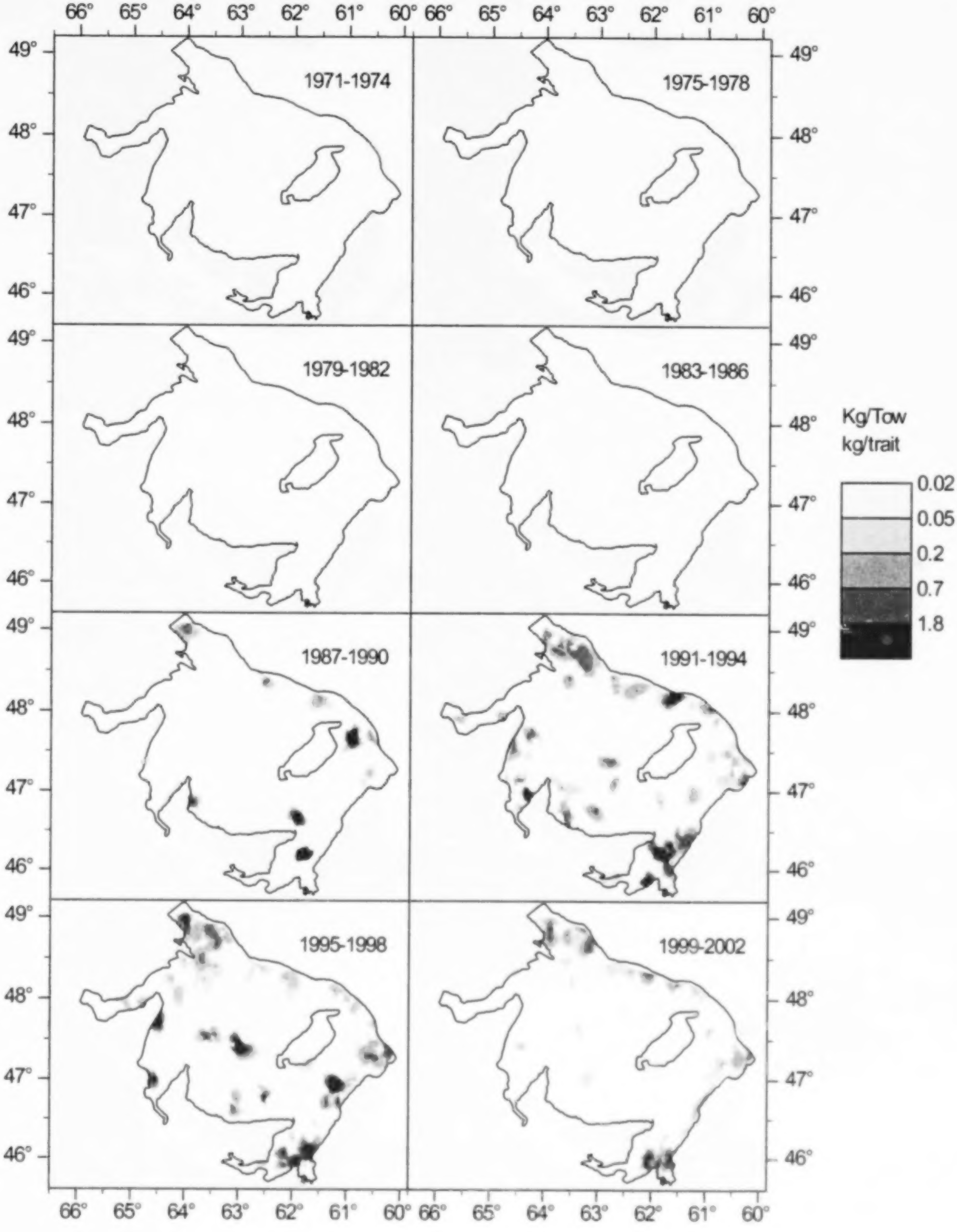

Figure 95. September distribution of catches (kg) of Mud Star, *Ctenodiscus crispatus*

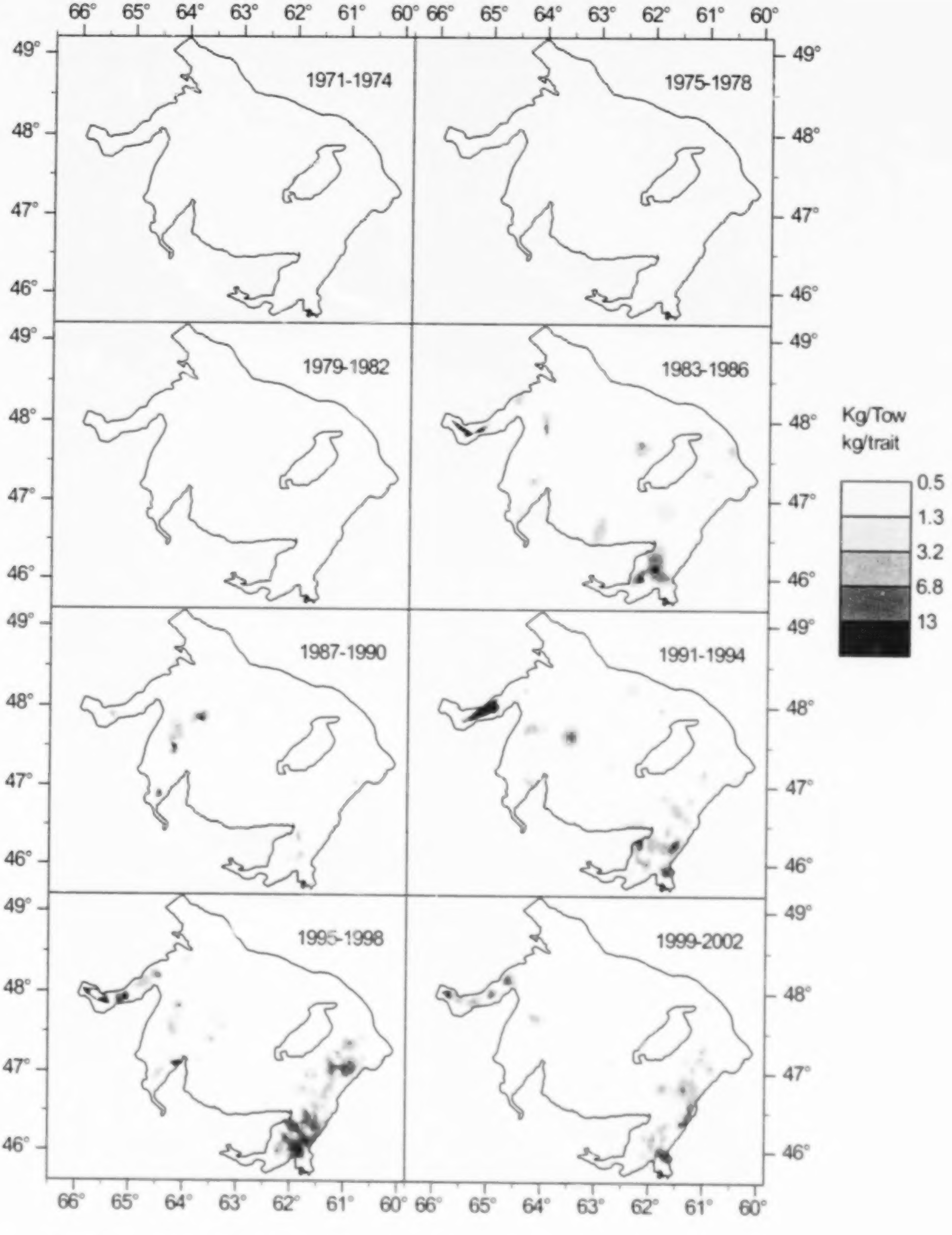

Figure 96. September distribution of catches (kg) of Brittle Stars, Ophiuroidea

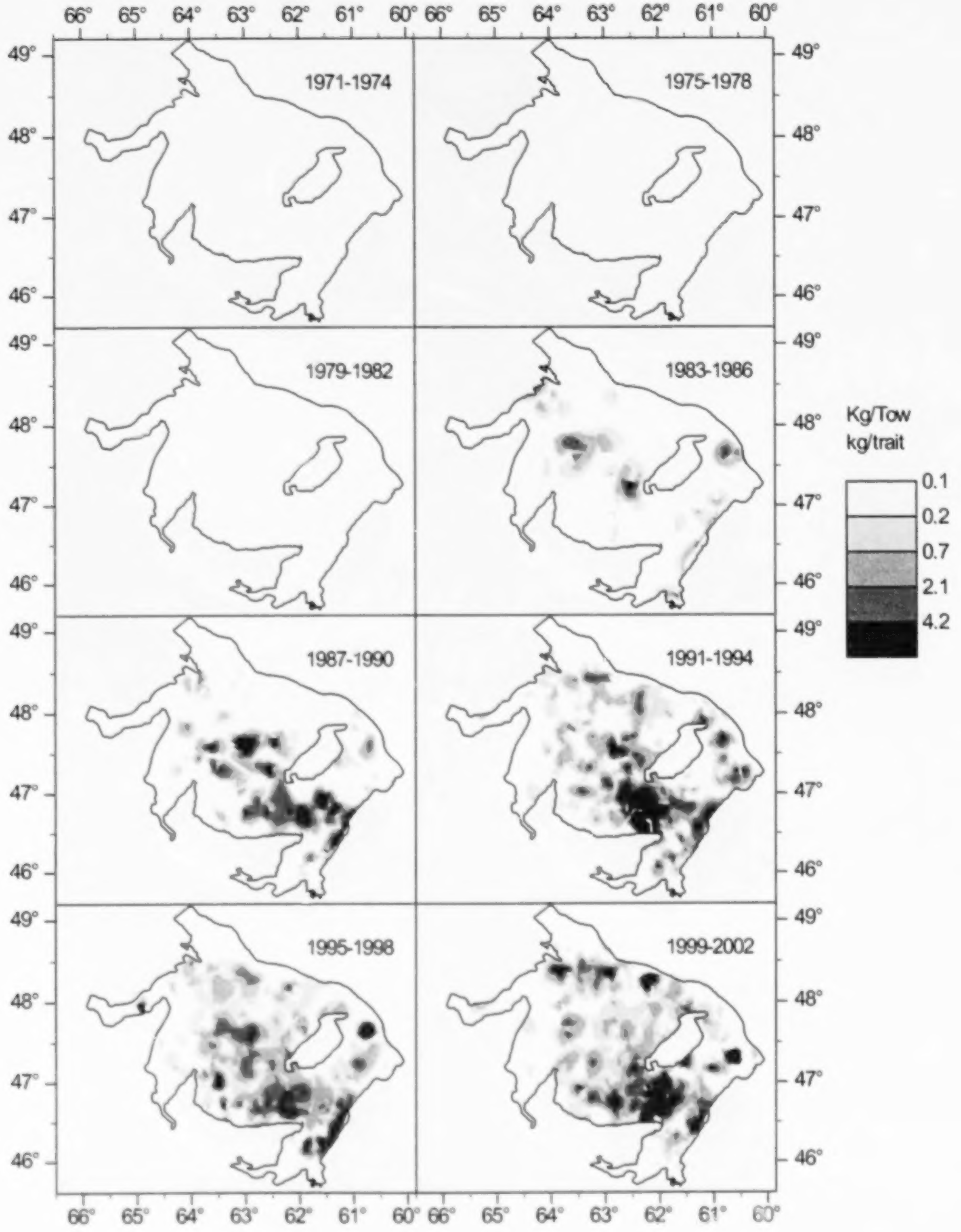

Figure 97. September distribution of catches (kg) of Basket Stars, Gorgonocephalida and Asteronychidae

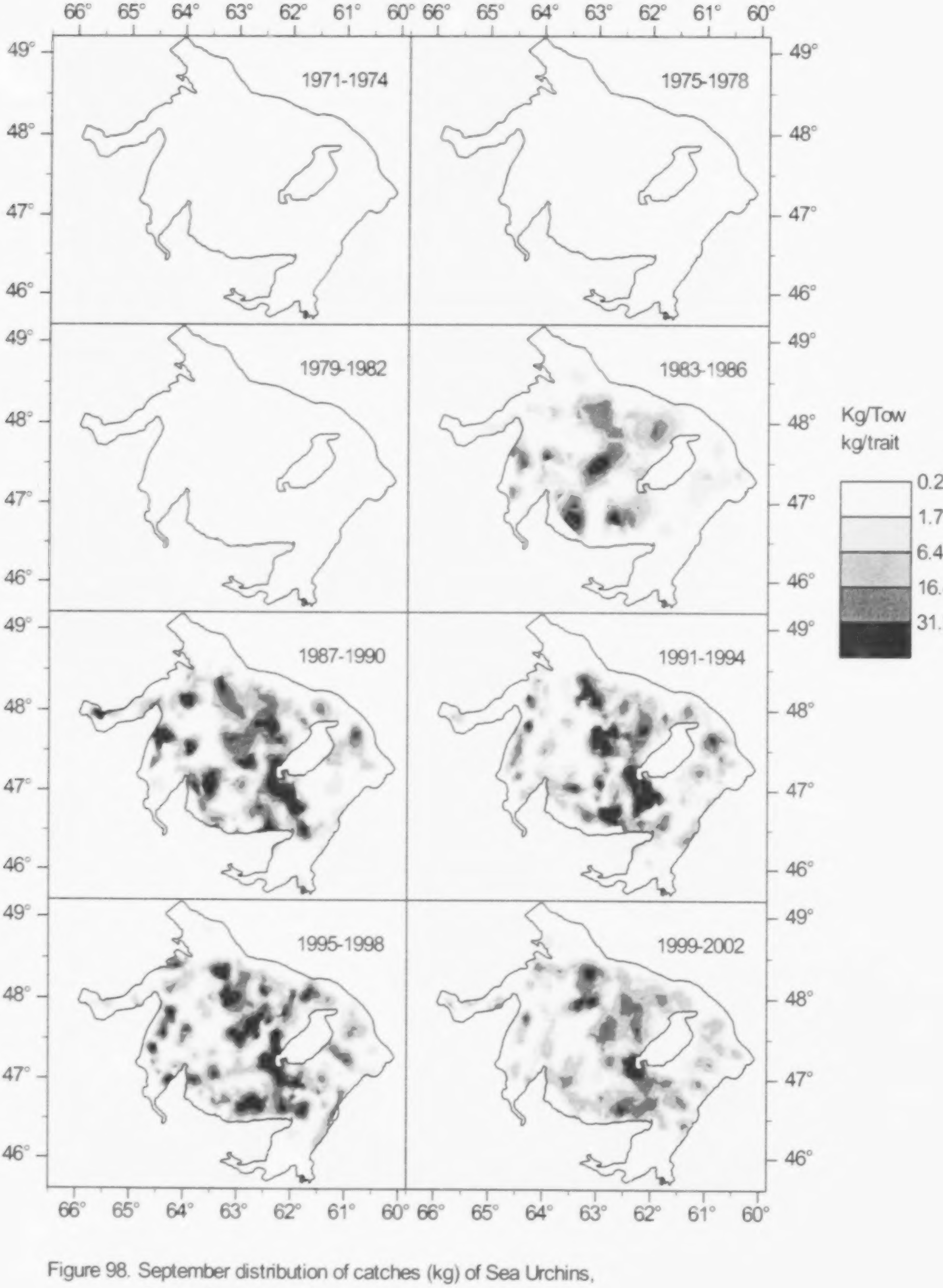

Figure 98. September distribution of catches (kg) of Sea Urchins, *Strongylocentrotus sp.*

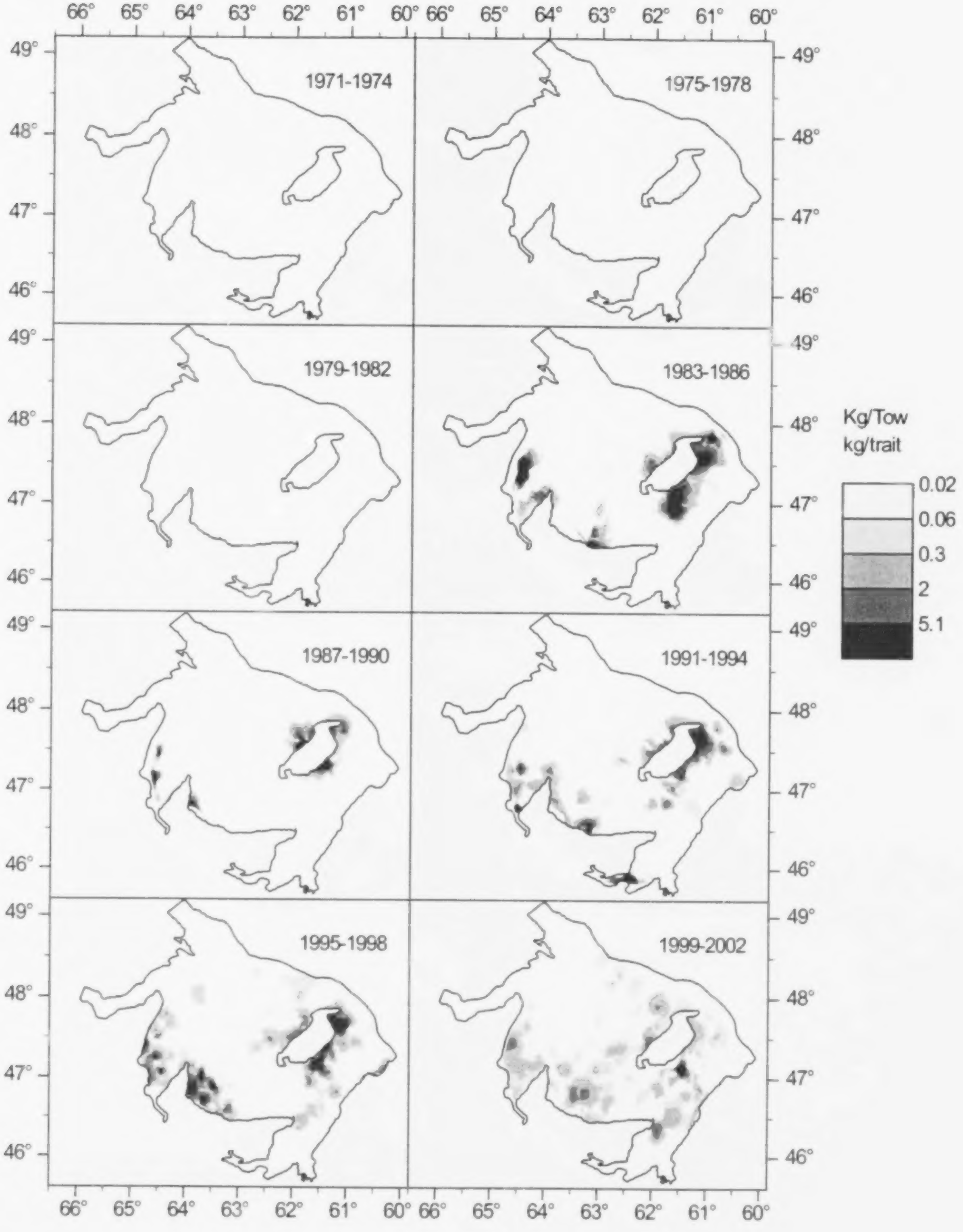

Figure 99. September distribution of catches (kg) of Sand dollars, Clypeasteroida

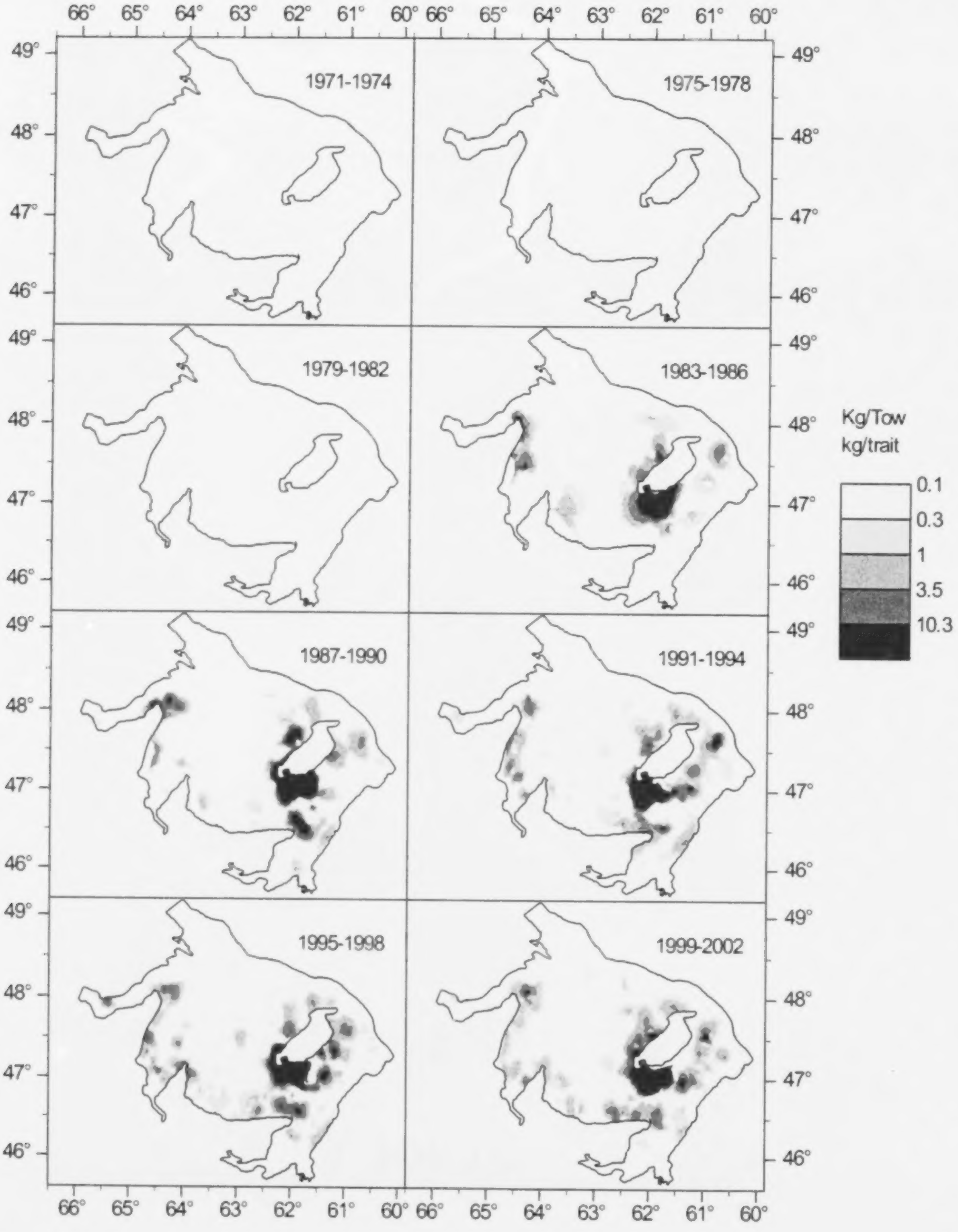

Figure 100. September distribution of catches (kg) of Sea Cucumbers, Holothuroidea

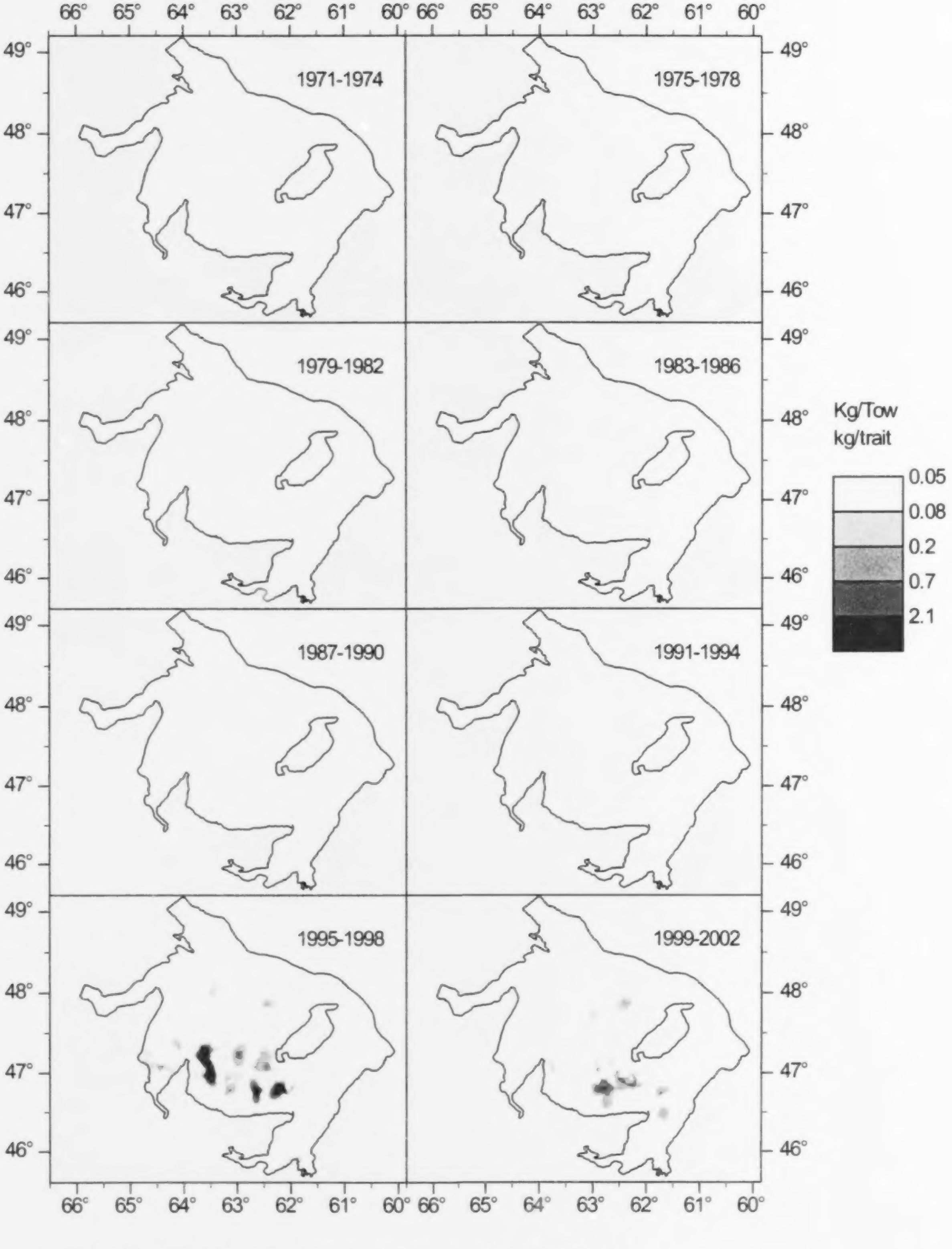

Figure 101. September distribution of catches (kg) of Scarlett Psolus, *Psolus fabricii*

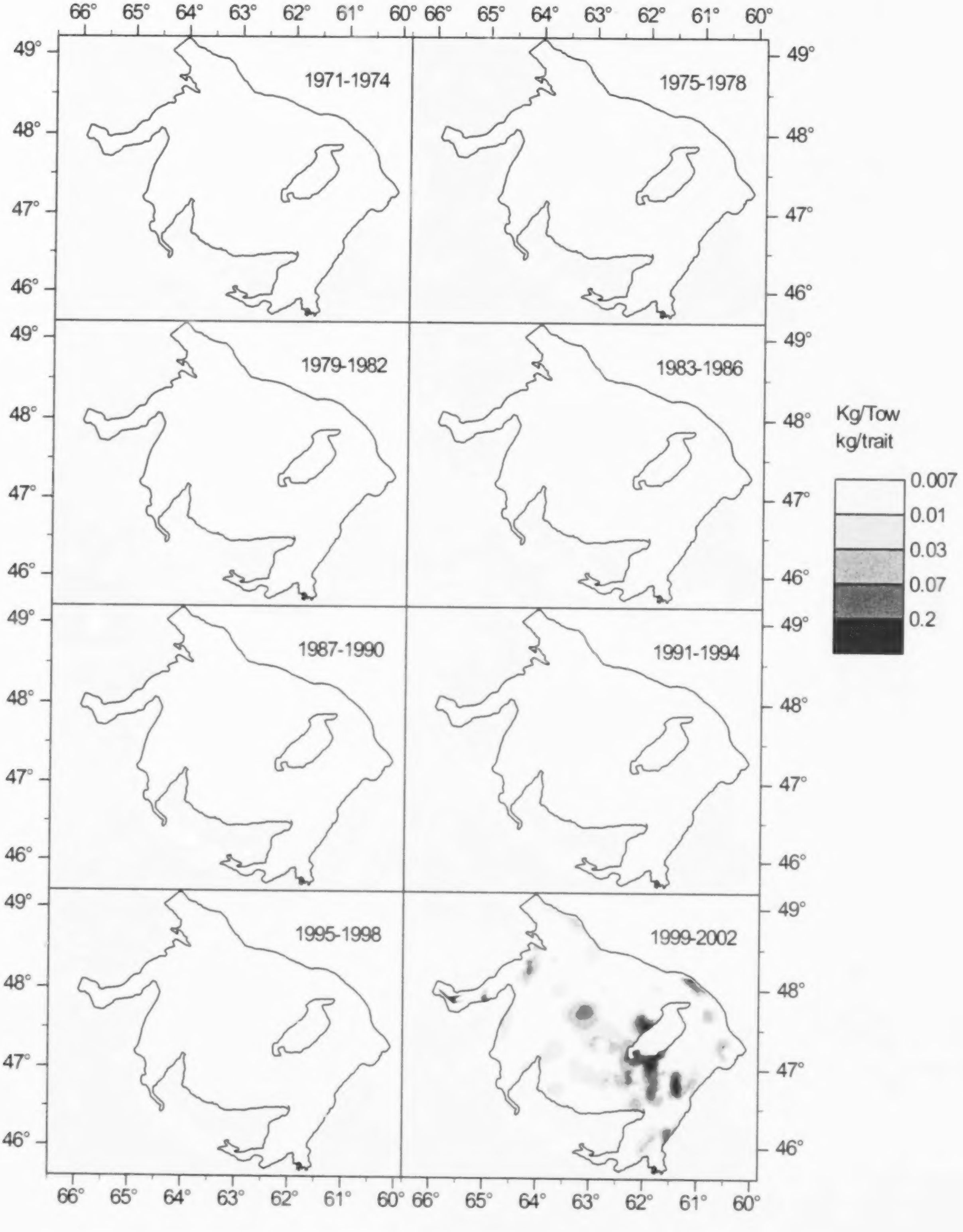

Figure 102. September distribution of catches (kg) of Polyps, Cnidaria

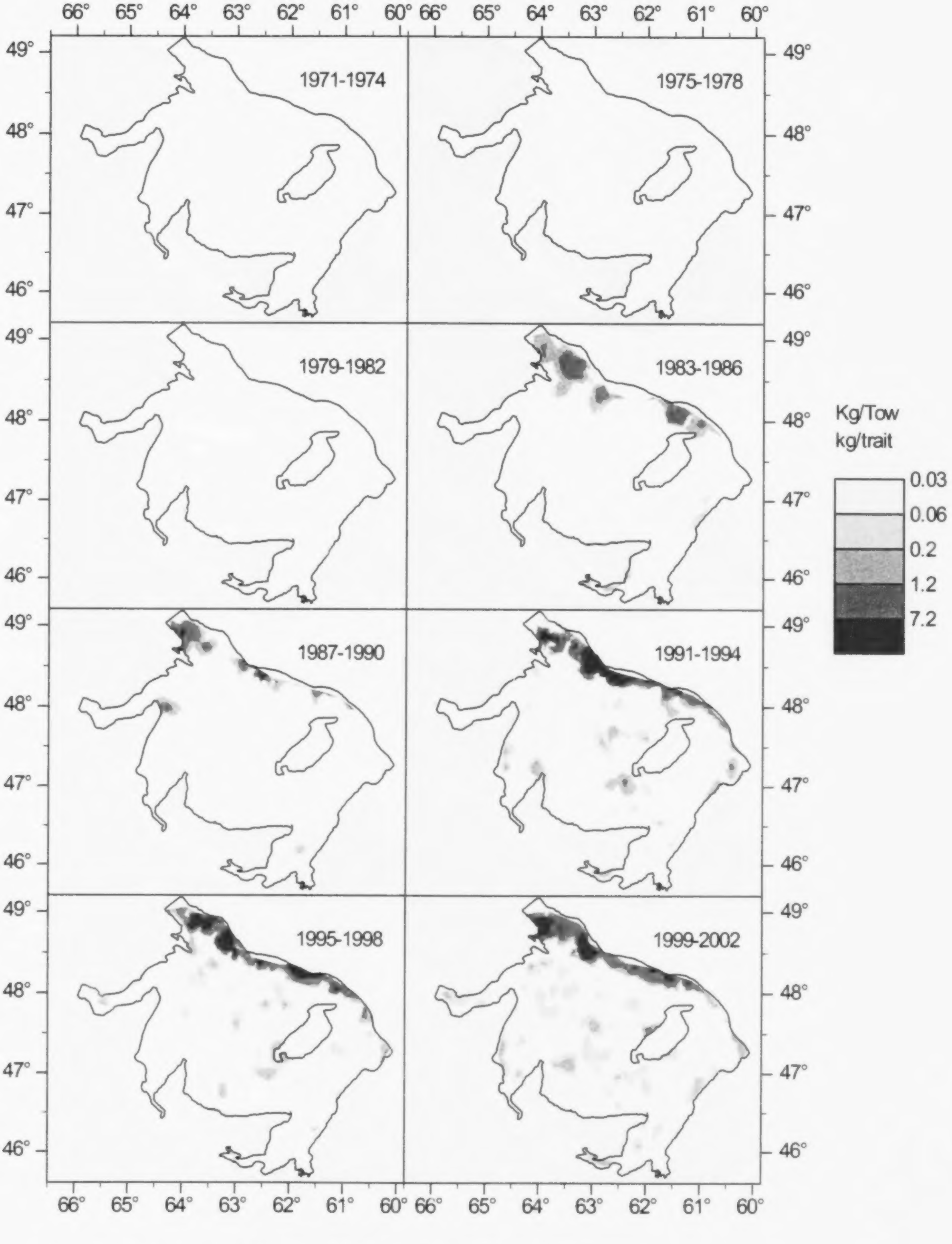

Figure 103. September distribution of catches (kg) of Sea Anemones, Anthozoa

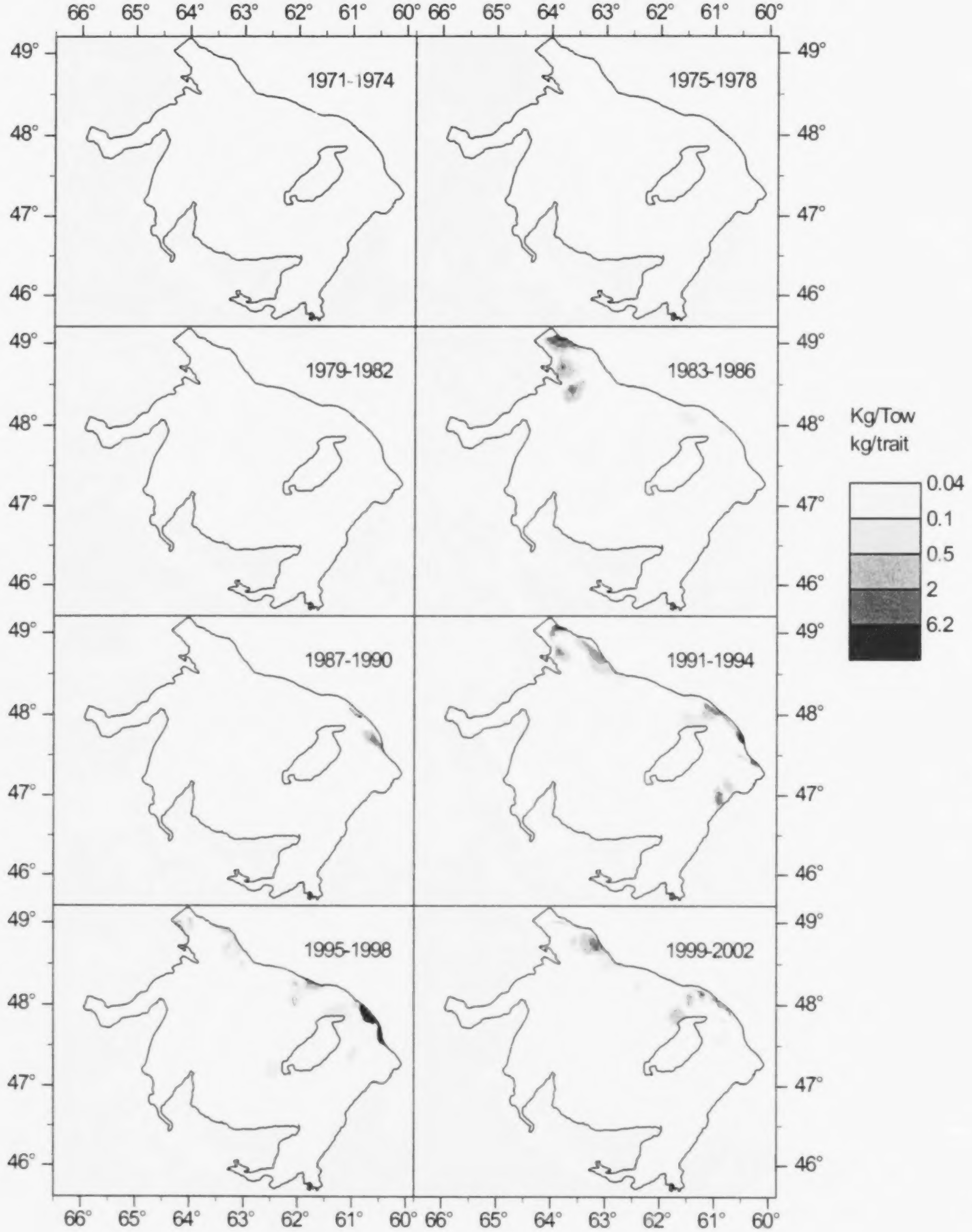

Figure 104. September distribution of catches (kg) of Great Sea Pen, *Pennatula borealis*

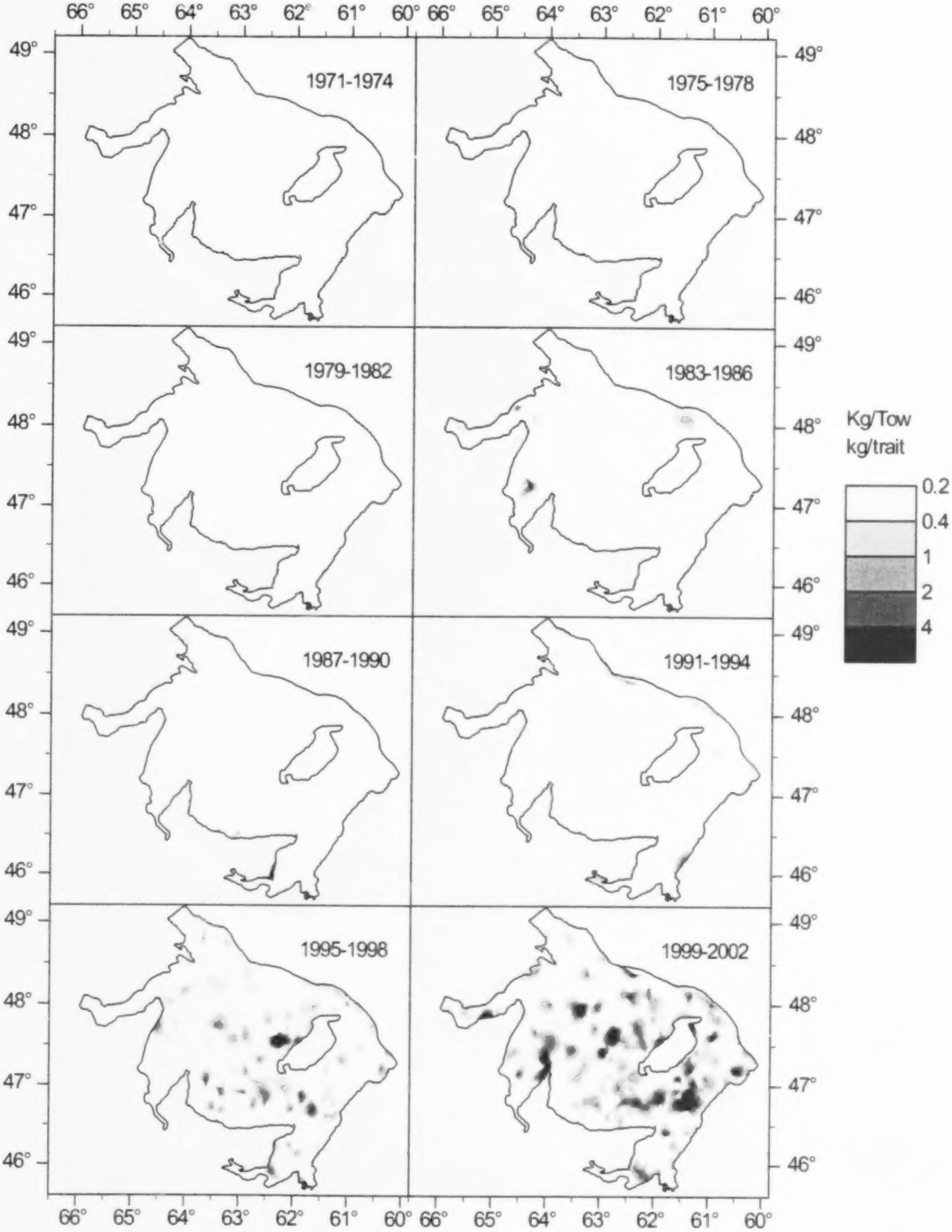

Figure 105. September distribution of catches (kg) of Large Jellyfish, Scyphozoa

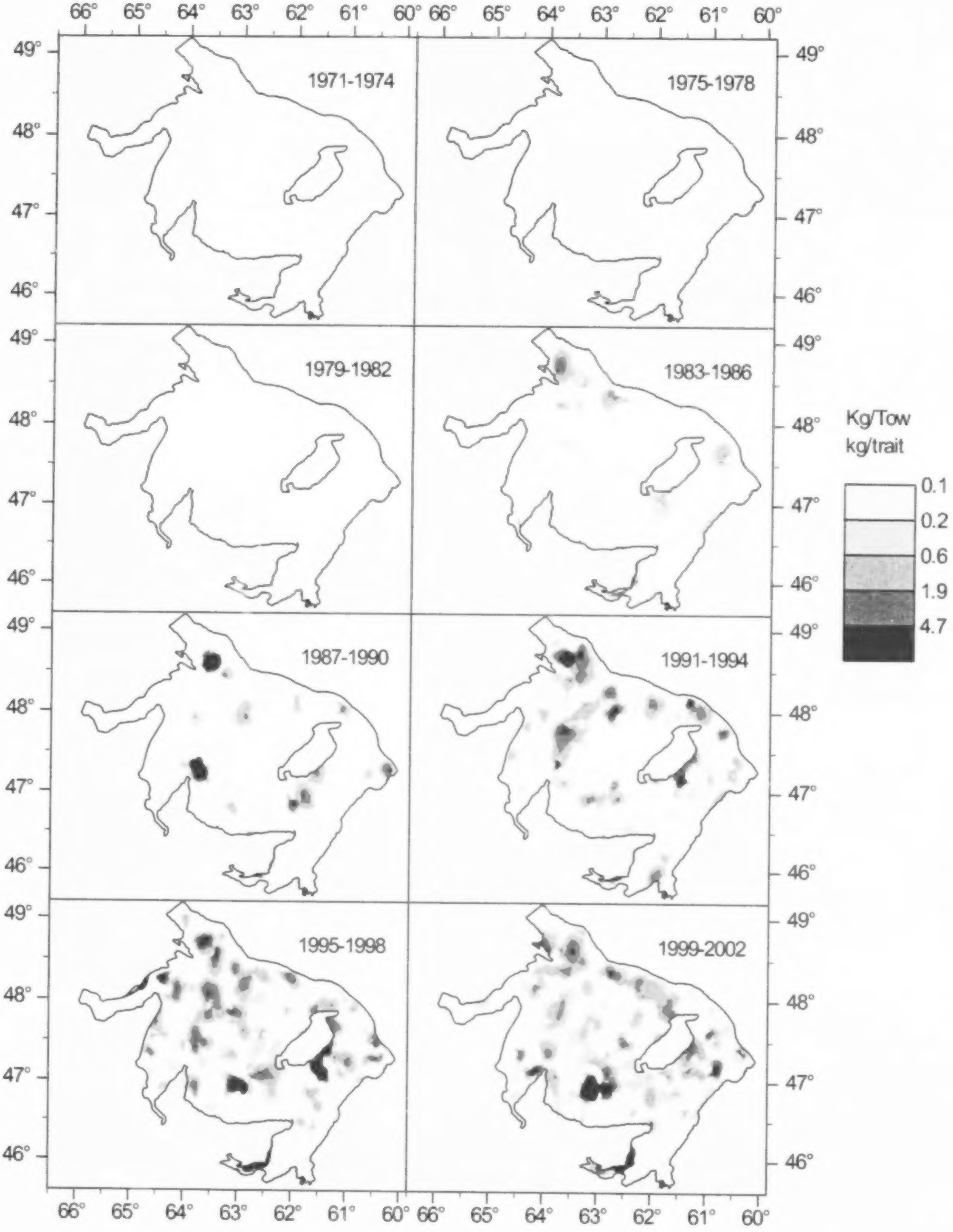

Figure 106. September distribution of catches (kg) of Sponges, Porifera

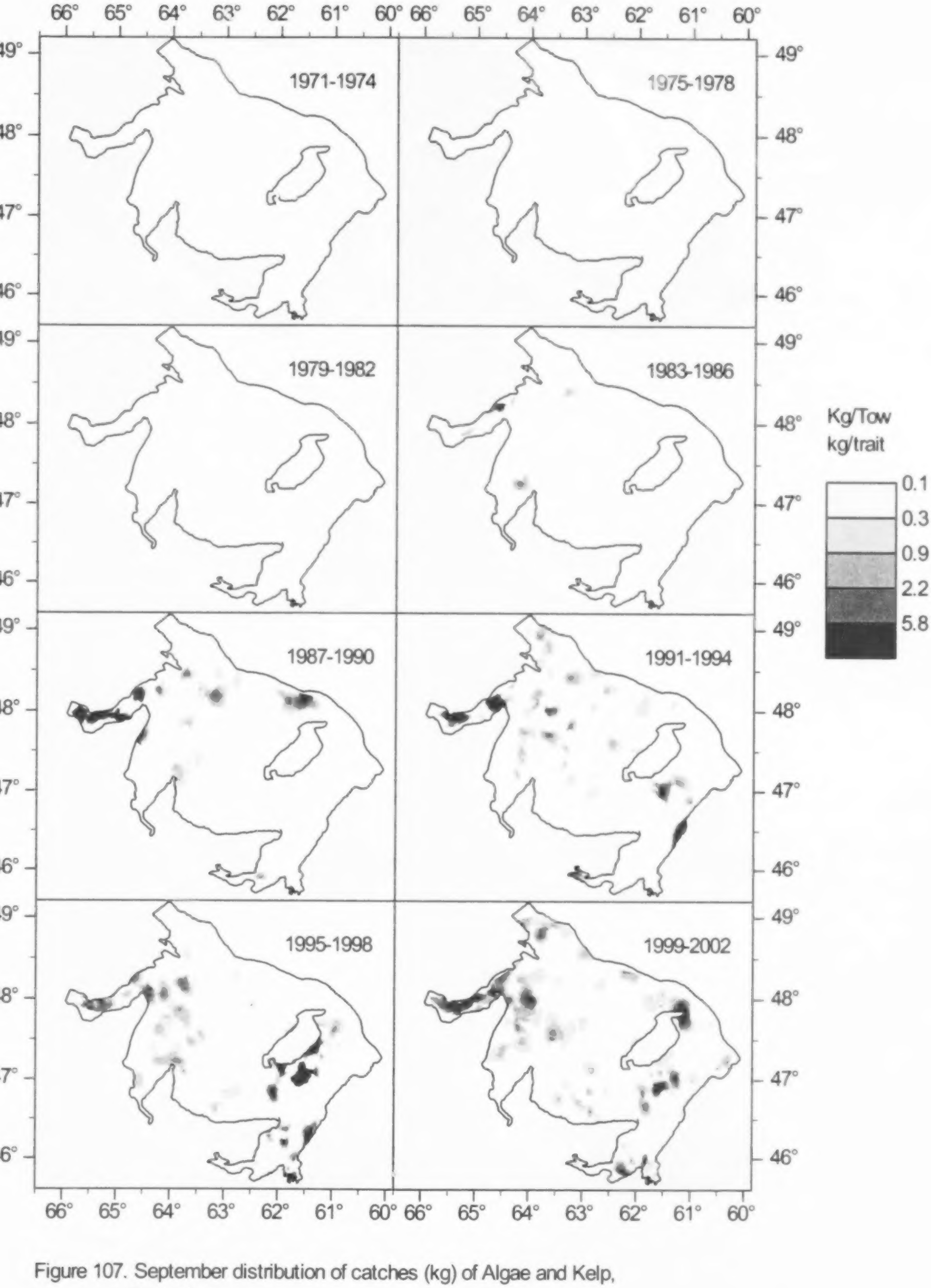

Figure 107. September distribution of catches (kg) of Algae and Kelp, Thallophyta

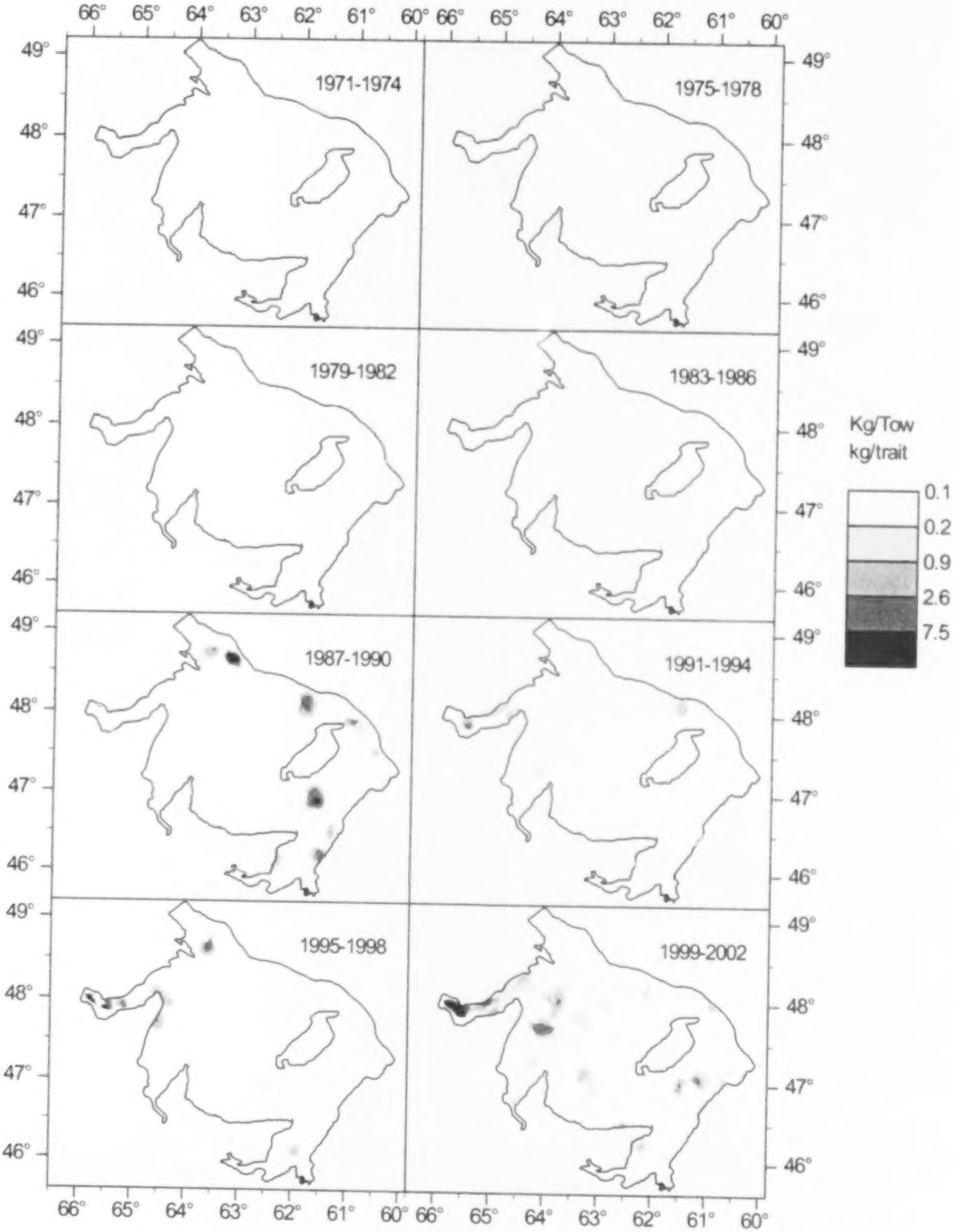

Figure 108. September distribution of catches (kg) of Garbage, Foreign Particles